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NOTES FOR THE MONTH.

Report on Fruit and Vegetables.

The Departmental Committee on Distribution and Prices of Agricultural Produce appointed by the Minister of Agriculture and Fisheries has now issued a second interim report* which deals with fruit and vegetables. A note on the first report, which concerned milk and milk products, appeared in the May issue of this *Journal*, p. 100. The Committee consists of the Marquess of Linlithgow (Chairman); Sir Basil Mayhew, K.B.E.; Mr. A. W. Ashby; Mr. E. R. Debenham; Dr. C. M. Douglas, C.B.; Mr. P. A. Hurd, M.P.; Mr. R. R. Robbins, C.B.E.; Mr. R. J. Thompson, O.B.E.; and Mrs. Margaret Wintringham, M.P.

The Committee has been at considerable trouble to obtain authoritative information from numerous producers', distributors' and consumers' organisations, and from other sources which were available. As a result the report is a mine of pertinent information on the organisation of the fruit and vegetable trade. It is illustrated by various interesting diagrams.

Growers should purchase the Report and study it for themselves, but it may be of interest to quote the concluding passages of the Report :—

"Finally, the picture presented to us by the evidence we have received is that of an industry deeply disturbed by war and post-war conditions. The less progressive growers and distributors appear to be waiting for a return to pre-war conditions. The more progressive growers and distributors, on the other hand, are fully alive to the needs of the moment. Perceiving the widespread change in prices and conditions of

* Second Interim Report of the Departmental Committee on Distribution and Prices of Agricultural Produce—Fruit and Vegetables. The Report can be obtained through any bookseller, or from H.M. Stationery Office, Imperial House, Kingsway, W.C.2 (price 3s.).

(19580). P.6./R.4. 9,250. 7/23. M. & S.

production and trade which are the aftermath of war, they are earnest in their endeavour to improve the methods and to lessen the costs of the various processes, whether of production or distribution, in which they are engaged. The best hope for the future lies with the industry itself. Producers must realise that marketing is the other half of production. They must make it their business to increase their knowledge of market conditions and requirements in order to dispose of their produce in the home markets to the best advantage in competition with produce grown in other lands. Distributors, for their part, must make every effort to eliminate archaic methods and to enhance the efficiency of the general distributive system. Retail distributors, in particular, should make serious efforts in the direction of increasing turnover when supplies are abundant, by charging lower prices to the consuming public. It should be the aim of all concerned in the industry to facilitate the passage of fruit and vegetables from the land to the home. The policy of preferring high prices and smaller turnovers to increased business on a lower price basis checks the even flow of supplies, and is inimical to the interests of the retailer himself, as, indeed, to the interests of all. In the course of this report we have set out numerous suggestions for improving the existing distributive machinery. Their cumulative effect upon the existing disparity ought to be substantial, and no opportunity of improvement, however slight, should be neglected."

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International Congress of Agriculture in Paris.

THE eleventh International Congress of Agriculture was held in Paris on the 22nd-26th May, and was attended by representatives from over twenty countries. The French Minister of Agriculture, M. Chéron, acted as Honorary President, and M. Méline, a former Minister of Agriculture, was President of this as of preceding Congresses. The Congress was indeed rendered possible by the financial assistance and help afforded by the French Government.

The work of the Congress was divided into seven sections and in practice took the form of discussions on subjects in regard to which papers had been contributed, winding up in most cases with resolutions expressing in a more or less definite form the view of the meeting. It afforded an opportunity for an exchange of views and a statement of the experience of different countries on matters of common interest. In all, no

fewer than 87 separate contributions were included in the proceedings of the Congress.

The scope of the Congress was in consequence very wide and covered a great variety of subjects, but it may be of interest to give some indication of the questions dealt with in the different Sections.

The first Section (Agronomy) was mainly devoted to questions relating to the improvement of wheat, potatoes and beet. A proposal was made to establish an International Association for the breeding of improved varieties of wheat, the idea being to establish a central office which would record the characteristics of all known varieties, promote the exchange of information between wheat breeders in all parts of the world, and publish a bulletin summarising results obtained in the improvement of wheat. Among other subjects this Section made a Recommendation that the international law as to patents should be extended so as to afford legal protection to the names under which new varieties of wheat are sold.

The third Section (Rural Economy) was of a less technical and more general character, the subjects discussed including the improvement of the lot of the agricultural worker, the development of agricultural associations, the taxation of land and the question of agricultural book-keeping.

On this last subject a paper was contributed by Sir Daniel Hall, and in the discussion which followed M. Laur, President of the Union des Paysans of Switzerland, drew attention to the remarkable progress which had been made in Switzerland by the adoption of a system whereby a book-keeper was employed co-operatively by an Association of farmers on a system similar to that adopted by milk recording Societies. By this means accurate accounts were kept on a very large number of farms. This was not merely of benefit to the individual farmers concerned, but the statistics of profit and loss thus obtained were of great value in meeting the criticisms of urban consumers regarding the prices of commodities like milk or meat, and in affording a reliable indication of the position of the industry.

The Live Stock Section dealt with milk recording as a means of developing milk production by the selection of cows with a high milk and butter yield, and increasing their commercial value. An allied subject which attracted a good deal of interest was the possibility of securing uniformity in the methods of judging stock and the system of entry in herd books, and also uniformity of certificates of origin and sanitary certificates of animals intended for export.

Other Sections of the Congress concerned themselves with vine growing, forestry, rural education and Colonial agriculture.

The meeting concluded with an excursion to some of the experiment stations near Paris, followed by longer excursions into Normandy, the Nivernais, and the wine producing area in the east of France.

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Prices and Supplies of Agricultural Produce in 1922.

THE Ministry's annual report on the prices and supplies of agricultural produce and requirements in 1922 has now been published. After reviewing the changes in prices and wages in 1922 as compared with previous years the position during the past 18 months is summed up by saying that while agricultural prices declined sharply in 1921, growers were able by reduced wages and reduced prices of feeding stuffs and fertilisers to produce more cheaply in 1922 than in the preceding year. This advantage, which might have enabled them to balance receipts against expenditure, was lost by the further fall in cereals and potatoes. The year was also unfavourable generally for growers of market garden crops, as the prices of these declined to about pre-war level when the heavy crops of 1922 came to be marketed. Some commodities, particularly sheep, realised fair prices.

The report contains a few short tables of the total supplies of the chief agricultural commodities in Great Britain, distinguishing the quantities produced at home from those imported. These tables bring out clearly the contribution which the agriculture of Great Britain makes to the total requirements, and show that the proportions of the total supplies which are produced at home vary considerably with the different kinds of agricultural produce.

With reference to these tables, it is observed that "These figures may be used to point to the extent of the dependence of Great Britain on imports, whether from Ireland or other parts of the Empire or from foreign countries. From another point of view it may be considered that having regard to the dense population of this country and its relatively small area the home contribution is fully as great as can be expected from the area of land available. But it must be admitted that the figures emphasize the magnitude of the market which lies at the door of the British agriculturist, and suggest that an expansion of home production in at least some of these directions ought not to be a matter of impossibility."

The report, which forms Part III of the Agricultural Statistics, 1922, is published by H.M. Stationery Office, and may be purchased through any bookseller, price 1s.

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The Agricultural Index Number.

ALTHOUGH there have been some appreciable changes in the prices of individual commodities, the general index number of the prices of agricultural produce remained unchanged in May at 54 per cent. above the level of 1911-13. On the whole therefore agricultural produce was some 10 per cent. lower in value than a year ago.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911-13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	—
July	186	112	72	—
August	193	131	67	—
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

All classes of British grain realised higher prices than in April, wheat advancing by 11d per cwt., barley by 5d. per cwt., and oats 8d. per cwt. Except in the case of barley there is usually a rise in May, but the increase this year has been relatively greater than before the War so that the index numbers increased by 3 to 6 points. Wheat at 37 per cent. above 1911-13 is higher than in any month since August last, but oats are still relatively dearer than wheat. Potatoes remained unchanged at 28 per cent. cheaper than in 1911-13, the slight fall in price in May being relatively the same as the decline in the base years. Hay usually becomes cheaper in the spring, but the decline this year was only 1s. per ton on the average, so that the index number shows a rise of one point. Hay is one of the few agricultural commodities which are dearer than a year ago, being now 41 per cent. above 1911-13 against 33 per cent. above in May, 1922.

Prices of fat cattle increased during May and were on the average about 3d. per stone higher than in April, this rise being

relatively greater than in the base years, and fat cattle realised prices 53 per cent. above those ruling in May, 1911-13, against an increase of 51 per cent. in April. As is usual, fat sheep and fat pigs declined in price, but the index number increased slightly in each case as the fall was relatively less than before the War. During May fat sheep were at rather more than double pre-war prices, and fat pigs 72 per cent. above. Dairy cattle have been in poor demand except for the best animals, and realised about £1 per head less than in April, being only 50 per cent. dearer than in 1911-13. Store cattle and sheep became dearer, but in each case they are relatively cheaper than fat stock. Store pigs, on the other hand, though cheaper than in April, were still at a much higher level than fat pigs.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1922.	1923.				
Commodity.	May	Jan.	Feb.	Mar.	Apr.	May
Wheat ...	62	33	28	27	31	37
Barley ...	49	20	12	8	11	16
Oats	53	43	39	36	39	42
Fat cattle ...	70	61	61	54	51	53
Fat sheep ...	140	103	97	94	100	103
Fat pigs ...	91	102	88	77	71	72
Dairy cows ...	66	74	67	58	55	50
Store cattle ...	38	36	36	31	29	33
Store sheep ...	100	105	100	92	92	98
Store pigs ...	97	171	154	136	131	126
Eggs... ...	56	86	46	55	37	43
Poultry ...	110	81	80	81	75	77
Milk	27	90	90	87	70	63
Butter ...	54	73	72	70	68	40
Cheese ...	48	85	88	95	92	42
Potatoes ...	140	—1*	—5*	—12*	—28*	—28*
Hay	33	43	42	42	40	41

Owing to the decline in the prices of imported cheese, and the consequent lower prices paid for milk sent by producers in excess of their basic quantities, the average price of milk declined from 70 to 63 per cent. above the pre-war summer contract prices. The average price is, however, well above May, 1922, when the increase over 1911-13 was only 27 per cent. Butter showed a sharp fall in May, British butter at country markets averaging 1s. 4¾d. per lb. against 1s. 10½d. in April, and was only 40 per cent. above the pre-war price. Cheese declined even more sharply and this season's cheese sold at only 42 per cent. more than in 1911-13, or 6 points lower

* Decrease.

than in May, 1922. Eggs recovered from the low level of April and were 43 per cent. dearer than before the War.

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Conciliation Committees in Agriculture.

THE Denbigh and Flint Conciliation Committee has reached an agreement to cover the period May to November, 1923, providing that wages in the area shall be (a) in the case of stockmen and horsemen 33s. for a week of 61 hours, to consist of 56 or 58 hours on weekdays and 5 or 3 hours respectively on Sunday, or 61 hours on weekdays, at the option of the employer; and (b) for other adult male workers 27s. 1d. for a week of 50 hours. A special clause stipulates that it is a fundamental condition of the agreement that the rates specified are minimum rates, and provision is also made for overtime, for rates for male workers under 21, for deductions from the cash wage in respect of allowances of board and lodging, and for a half-day being allowed on Saturdays wherever possible. The Merioneth and Montgomery Committee has also reached an agreement to continue to November, 1923, the terms being a rate of 31s. for 60 hours in the case of stockmen and wagoners, and a rate of 28s. for 52 hours in the case of other adult male workers. For Carnarvon an agreement has been made providing for a wage of 32s. 6d. (or 18s. in cash and board and lodging valued at 14s. 6d.) for a week of 60 hours. In the case of the Brecon and Radnor Committee an agreement has been reached on the recommendation of the Independent Chairman, providing for a rate for adult male workers of 30s. for a week of 53 hours.

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A Parasite of the Woolly Aphis.

IN view of the references in the technical Press to *Aphelinus mali*, a Chalcid parasite of the Woolly Aphis, it may interest *Journal* readers to know that a flourishing colony of this parasite exists at the Ministry's Pathological Laboratory at Harpenden. By the kindness of Dr. Marchal, of Paris, a small supply of parasitised Woolly Aphis was received early in the year. The Chalcid flies emerged from the dead aphides during April and were introduced into a cage containing a small Cox's Orange Pippin heavily infested with Woolly Aphis. The Chalcids bred satisfactorily and at the date of writing a further generation of flies is appearing. It is hoped that before the close of the summer sufficient stock will be available to make a limited distribution of the parasite to one or two centres in fruit-growing districts, and that these centres will next year

be able to provide sufficient material for a more general distribution. It is quite impossible at present to predict whether the parasite will prove of real importance in the control of Woolly Aphis, but there is already sufficient evidence to show that an extensive trial is worth while. Further information on the subject will appear in this *Journal* as soon as the experiments are in a more advanced stage.

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Weighing of Cattle: A Successful Experiment in Cornwall.

THE provision of weigh-bridges in sale yards is not yet general throughout the country, though at most sale yards in Scotland and the north of England fat cattle pass over the weigh-bridge before entering the sale ring, and the same system is adopted at many markets in other districts of England and Wales.

During the War all cattle were graded and sold by live weight, and although the system was much abused by farmers at first, they soon found out by weighing their cattle and selling by live weight, that they had in many instances given away to butchers and dealers a considerable quantity of beef and mutton under the old system of selling their stock at so much per head.

The grading scheme was much appreciated by the majority of Cornish farmers, and when it came to an end the farmers wished to continue to sell their cattle by live weight. The butchers and dealers, and to a certain extent the auctioneers, were not in favour but preferred to buy the cattle as they stood at a price per head, and consequently strong opposition was forthcoming. The Cornish Farmers' Union, however, were strongly in favour of the scheme of selling by live weight, and it was only after they decided to appoint their own auctioneer that the other parties consented to give it a trial.

The system adopted at Truro, Helston and other markets in Cornwall is as follows:—An ex-soldier is appointed and paid by the Farmers' Union at the rate of 2d. for each head of stock weighed, with a minimum pay of 10s. per day. He has to superintend the weigh-bridge and book the weight of each beast, and as the animal enters the sale ring he calls out the live weight and this is booked down by the auctioneer's clerk. The bidding is then conducted at so much per live cwt., and the necessary calculation for the total price of the animal is afterwards worked out by the auctioneer's staff. In case of any dispute the weight

as booked by the ex-soldier is accepted as final. In cases where a fat cow or heifer is found, when slaughtered, to be in calf, a claim can be lodged by the purchaser with the auctioneer, and the vendor has to make some allowance. Generally this is met by the weight of the calf being deducted from the live weight of the animal, and in some cases a claim of up to £8 has to be met.

This system is in vogue in Cornwall at the present time and appears to give satisfaction to all parties. It has not been found to drive butchers and dealers to other markets for their supplies of fat stock. The system has, moreover, proved to be a great boon to a large number of young butchers, many of them ex-Service men of no great experience. The more experienced butchers now raise no objection, although they admit the other system suited them best, as they are now no longer able to get the "snips" which their experience enabled them to obtain on some occasions in former days. The auctioneers state that the disadvantage from their point of view is that the system involves more clerical work, but this is now much simplified by the use of ready reckoners.

The farmers are well satisfied with the scheme and feel they are now paid in full for their cattle, and it has a tendency to make them send their cattle to market in better condition. They see exactly what the butcher is prepared to pay per cwt. for well-finished cattle, compared with poorly fed beasts of inferior quality. The system could with advantage be adopted in other districts of the country.

A well-known Cornish farmer observed: "The selling by live weight is one of the best things the farmer has had for years, and selling cattle per head is dead for ever as far as Cornwall is concerned."

A great number of fat pigs are also sold by live weight in Cornwall, but not in the markets. The usual procedure is for the farmer to offer his pigs to buyers attending markets at a price per score lb. live weight delivered at the nearest railway station, and the pigs are then weighed at the station before being put on rail. This system is much in favour, as to send pigs to market entails men's time, horses and waggons, and also market tolls and other expenses, which are to a great extent avoided by delivering direct to a station, probably at a time when cake or manures have to be taken home.

Sheep are not sold by live weight but are often sold at so much per lb. dead weight, the seller to be present when the carcasses are weighed.

THE WEATHER AND THE FARMER.

THE farmer is doubly interested in the weather. He needs to know, for as long beforehand as possible, what the weather is going to be; he is concerned, though to a less degree, with what the weather has been. Before almost every farming operation, haymaking, harvesting, ploughing, sowing, spraying, etc., he must exercise his weather wisdom; the progress of his crops will often cause him to consult his weather memory. It is the same with the market gardener and the fruit grower. For these, forecasts of the likelihood of rain at sowing or planting-out time and, particularly, warnings of probable night frosts and following sunshine should be of great benefit. Both in (1) forecasting future weather, and (2) in recording weather that is past, considerable assistance may be obtained from the Meteorological Office.*

I. **Weather Forecasts.**—A weather forecast is a brief description of the weather which is regarded as probable during the period to which the forecast relates. It is only expected to apply to the district specified when the forecast is issued.

For the purpose of compiling forecasts, observations are taken at the same hour four times daily at a large number of stations and telegraphed to the Meteorological Office. That Office then prepares weather maps embodying the main features of these observations and compiles forecasts accordingly.

A. *Forecasts by Telephone.*—Arrangements have been made for weather forecasts to be distributed each afternoon to telephone exchanges. For this purpose Great Britain has been divided into forty districts, and each exchange will have the forecast appropriate to the area in which it is situated.

The forecasts cover the period from six o'clock on the evening of the day of issue until six o'clock on the evening of the following day. The forecasts are available between five o'clock and midnight each day on demand by telephone and should be of special benefit to farmers and other residents in rural areas.

No charge, apart from any cost of telephoning, is made for these forecasts.

B. *Published Forecasts.*—A map based on observations taken at 6 p.m. is published in some of the London morning newspapers. It is accompanied by a "general inference," that is to say, a general description of probable weather movements,

* Communications should be addressed to the Director, Meteorological Office, Air Ministry, Kingsway, London, W.C.2.

and by forecasts for different districts of the British Isles ("district forecasts") for the next 30 hours, *i.e.*, until the following midnight. Other newspapers (town and country) usually publish the "general inference" and the "district forecast" but not the map; information necessary for constructing a map is distributed by wireless telegraphy (see paragraph 3 immediately below).

C. *Forecasts by Wireless Telegraphy.**—1. About 9 a.m., 3 p.m., and 8 p.m. G.M.T. each day "district forecasts" in code are broadcast by wireless telegraphy from London.

2. At 9.15 a.m. and 8 p.m. G.M.T. the "general inference" is sent out in plain language.

Those who possess wireless sets can thus obtain considerably later information than that published in the newspapers. Such up-to-date information is of especial value in the British Isles, where, as is well-known, the progress of the weather, for reasons which will be found explained in any book on the subject, is liable to rapid changes.

3. In addition to the above the Meteorological Office broadcasts in code four times daily the observations recorded one hour previously at 17 British stations. From these observations weather maps can be constructed.

D. *Forecasts by Wireless Telephony.*—A weather forecast for the following 24 hours for the area within a radius of about 50 miles of London is issued from the London station of the British Broadcasting Company at about 7 p.m. and 9.30 p.m. The forecast is followed by a statement of the barometer readings at certain stations. The readings given in the first message are those taken at 1 p.m., and in the second message those taken at 6 p.m. The pressure values given in the message refer to Mean Sea Level, *i.e.*, they are comparable with readings from a mercury barometer after the latter have been corrected, and reduced to sea level.

Forecasts for their respective areas are also issued from the Broadcasting Stations at Birmingham, Manchester, Cardiff, Newcastle and Glasgow. These issues are made at about 6.30 p.m. and 9 p.m.

E. *Forecasts by Telegram.*†—1. *Regular Forecasts.*—Regular

* Full information as to these wireless messages, with a key to the code used, is to be found in "The Wireless Weather Manual" (M.O.255) (London, H.M. Stationery Office, price 9d.). Full particulars of the coded data messages issued in this and other European countries will be found in "Particulars of Meteorological Reports issued by Wireless Telegraphy," M.O. 252, Price 2s. 6d. Supplements issued from time to time give notice of changes.

† Further particulars which are given in M.O. Form 2450 should be obtained from the Meteorological Office.

forecasts for 24 hours or more in advance are despatched by telegram daily to subscribers. These forecasts are normally issued in the afternoon, to cover the weather of the following day, but forecasts for the same day can be issued in the early morning if desired. For these telegrams a fee of 6d. per week, plus telegraphic costs (calculated on an average of 1s. 3d. per message) is charged.

2. *Spells of Settled Weather.*—Another type of forecast, which is sent by telegram, gives notifications of the setting in of spells of fair settled weather and of their break-up. These telegrams tions. The charge from May to September is 6d. for each forecast, in other months 2s. 6d., in addition to the cost of telegraphy.

> Those desirous of obtaining forecasts of either type (1) or (2) above should communicate with the Director of the Meteorological Office, Air Ministry, Kingsway, London, W.C.2, enclosing a postal order or a cheque to cover the cost of the messages required; in the case of the type (2) a deposit of not less than 7s. 6d. should be sent, any unexpended balance being returned on the conclusion of the service. The shortest address which may be used for the telegrams should be stated.

3. *Special Forecasts.*—The Meteorological Office will send by telegraph forecasts of such conditions as spells of frost, ground frost, etc., at a fee of 2s. 6d. plus cost of telegram

The observations broadcast in code by wireless telegraphy by the Meteorological Office (see paragraph C.3 above) should be used extensively by amateurs, many of whom may care to take the opportunity of keeping themselves up-to-date with weather movements.

Failing this a study from day to day of the map published in the newspapers together with some knowledge of the methods used by scientific forecasters will give anyone who cares to take a little trouble a useful stock of weather wisdom. And it is hoped that many will take this little trouble, for it is only by such general effort that the science of one generation can become the common knowledge of the next. Considerable assistance is also afforded in this direction by the maps issued with the Daily Weather Report (see below).

It is of great importance, too, that volunteers should be found to undertake the task of comparing general weather with local weather. In various parts of the country there is a great deal of local weather-wisdom, which, owing to the more unsettled conditions of modern life, is in danger of being forgotten. It is to be remembered that the Meteorological Office can only give a

general forecast applicable to the district as a whole and a knowledge of local peculiarities will often enable a local observer to modify the general forecasts accordingly.

NOTE.—The maps issued with the "Daily Weather Report" of the Meteorological Office will be found very useful for checking maps prepared by those interested from the observations sent out by the Meteorological Office. The "Daily Weather Report" is issued in three sections: (1) British Section, (2) International Section, (3) Upper Air Section. The British Section is issued at noon, with "general inference" and "district forecasts."

The cost, post free, of any one section is 6s. 6d. per quarter, or 13s. for all three sections. The International Section is probably the most useful for the study of weather, but the British Section must be referred to for the data for the British Isles which it gives. Further particulars may be obtained from the Meteorological Office.

The following books, which may be obtained through any book-seller, may be recommended :—

The *Weather Map*, by Sir Napier Shaw. (London, H.M. Stationery Office, Imperial House, Kingsway, W.C.2, price 1s. 3d., postage 1d.)

Meteorology, by R. G. K. Lempfert, M.A. (London, Methuen, 7s. 6d. net.)

A Short Course in Elementary Meteorology, by W. H. Pick, M.A. (London, H.M. Stationery Office, 1s. 6d., postage 2d.)

Forecasting Weather, by Sir Napier Shaw, F.R.S., Sc.D. (London, Constable. New Edition in preparation.)

The Weekly and Monthly Weather Reports (see below) will also be useful.

A Meteorological Glossary. (London, H.M. Stationery Office, 1s., postage 2½d.)

II. **Weather Records.**—A. *Records for Long Periods.*—Climate and soil are of chief importance in deciding what crops to grow. Climate summarises the weather of any particular locality and its variations.* When the weather has been observed for a sufficiently long time, we are able to obtain valuable particulars of the average temperature, rainfall, etc., at different times of the year at each place, besides (what is also very important) knowing whether the climate is equable or fickle.

There is still much to be done in determining what sort of climate best suits each crop. It is known, for instance, that, generally speaking, the climate of eastern England is better suited to wheat than is that of the west. But certain varieties might be found to stand the western climate better than others: and where a crop is found to be unsatisfactory in a

* *See* the article on "Climate" in the Meteorological Glossary. (London, H.M. Stationery Office, price 1s.)

district, it may be profitable to cultivate a variety more suited to the climate. Again, there are certain critical periods in the growth of most plants; and where unfavourable conditions often prevail just at a critical period, it might be advisable to select varieties of which the critical period falls earlier or later. Tables showing the average rainfall, temperature, etc., at different times of the year are published by the Meteorological Office. With a knowledge of the requirements of the crops and live stock, a farmer moving to a new district, or trying a new crop, such as sugar beet, in a familiar district, could by studying these records, form some opinion as to how far he is likely to be successful.

NOTE.—The averages are published in the "Book of Normals." Section I of the "Book of Normals" gives monthly averages of Temperature, Rainfall and Sunshine for over 200 British stations. Section II gives weekly, monthly, quarterly and seasonal averages for the twelve weather districts of the British Isles. Section III contains coloured maps, based on Section I, showing average monthly temperature (highest day and lowest night) rainfall and sunshine. Section IV (in the press) will give for selected stations the temperatures in greater detail, and also the frequency of days of gale, frost, snow, snow-lying and hail. The latter tables should be of value in questions of agricultural insurance. Sections I, II and III are obtainable from H.M. Stationery Office, price 2s., 9d. and 1s. 6d. respectively.

B. *Current Records.*—As mentioned above, much more information is still wanted as to the climatic requirements of each crop, and also as to the effect of the weather at any given period. The weekly and monthly records of the weather will show what have been the outstanding features in successive weeks or months. It will not always do to say that a spell of unusual weather has necessarily been the cause of a large or small crop; the connection between the two is a subject of research, to be undertaken by Research Institutes, Agricultural Colleges and similar Institutions. Vague statements concerning the weather are apt to be misleading, and the appearance of the growing crop is not the sole guide to the ultimate yield. But by carefully watching weather records, and the changes in the growing crops, farmers should obtain much valuable knowledge of the effect of unusual rain or warmth, etc. By keeping such records themselves, and afterwards measuring the yields of their crops, farmers will in time not only learn which weather conditions are really favourable or the reverse on their own soil, but will assist in solving the general problem of each plant's likes and dislikes.*

* For an outline of the more scientific aspect of the influence of weather on crops see this *Journal* for August, 1922, p. 432.

NOTE.—The Weekly Weather Report gives details of weather (warmth, rainfall and sunshine at over 20 stations) for the past week; notes on the wind, and also a summary of the weather for the week, and for the season and year in progress, as compared with the normal weather.

The Monthly Weather Report summarises weather records from some 300 stations and publishes five charts (wind, movements of depressions—*i.e.*, regions of low barometric pressure, temperature, sunshine and rainfall).

The Annual Summary does much the same for the year.

The Annual Subscription to the Weekly Weather Report, including Introduction and Guide to the Tables, is £2, post free.

The Annual Subscription to the Monthly Weather Report, including the Introduction and Annual Summary, is 10s., post free.

Specimen copies of the Daily, Weekly and Monthly reports may be obtained free from the Meteorological Office.

NOTE.—Orders should be made out as follows:—

Daily Weather Report.—To the Director, Meteorological Office, Air Ministry, Kingsway, London, W.C.2, remittances being made payable to the "Deputy Secretary, Air Ministry," and crossed "Bank of England A/c of Paymaster General."

Weekly Weather Report and Monthly Weather Report.—To the Director of Publications, H.M. Stationery Office, at any of the following addresses:—

Imperial House, Kingsway, London, W.C.2;
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ALSIKE CLOVER.

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ALSIKE clover (*Trifolium hybridum*) derives its common name from the fact that it was first introduced into this country from the village of Alsike in Sweden. Unlike red clover and white clover it is not indigenous to Britain, but is native to temperate Europe and occurs also in Asia and Algeria: it is not common in Southern Europe. The specific name of *hybridum* was given to it by Linnaeus who erroneously regarded it as a hybrid between red clover and white clover.

Description of the Plant (see Plate I).—Alsike clover is a perennial plant, although in this country it does not usually persist in quantity for more than from three to five years. In manner

of growth it comes nearer to late-flowering red clover than to broad red clover.

It can readily be distinguished from all forms of red clover by the fact that the plant is quite devoid of hairs. The leaves are slightly toothed and the flower head, which is usually pale pink is borne on a fairly long stalk. The stipule at the base of the leaf stalk is quite different from that of red clover: in the case of red clover the stipule is attached to the stem of the leaf for the greater part of its (the stipule's) length, and ends in a bristle-like point; the stipule of Alsike clover is not joined to the stem of the leaf in the same way and gradually tapers to a fairly long point.

Alsike clover is rather more surface-rooting than the red clovers, but if adult plants of the two species are compared it will usually be found that Alsike clover has produced the greater mass of roots.

Alsike clover is variable but not to the same extent as red clover, and there is certainly not so much diversity amongst the cultivated forms as with red clover.

Description of the Seed and Impurities (see Plate II).—The seeds of Alsike clover, like those of white clover, are heart-shaped, but plump, the seeds of the two species being about the same size. Alsike gives about 715,000 and white about 760,000 seeds to the pound. The seeds of both species are smaller than those of red clover which gives 230,000 to 279,000 seeds to the pound. The seeds of Alsike clover are usually of various shades of green deepening almost to blue or black, the seeds frequently having a somewhat marbled appearance. Good samples should be bright with a nice colour range—older and poorly harvested samples usually assume a uniform brown or reddish brown colour.

Alsike clover is grown for seed in this country, but not to the same extent as red clover, most of the seed on the market being imported, chiefly from North America and from the Continent. Home-grown seed and that from America does not frequently contain dodder, but samples from Europe are often contaminated with the seeds of this parasite.

Samples of Alsike clover are liable to contain as much impurity as red clover and sometimes more. The chief weed impurities met with are Sheep's Sorrel (*Rumex Acetosella*), Self Heal (*Prunella vulgaris*), Campion (*Lychnis* and *Silene* spp.), Soft Cranesbill (*Geranium molle* and *pusillum*), Rib Grass

PLATE 1.—Alsike Clover (*Trifolium hybridum*) in Flower (natural size) and Seedling.

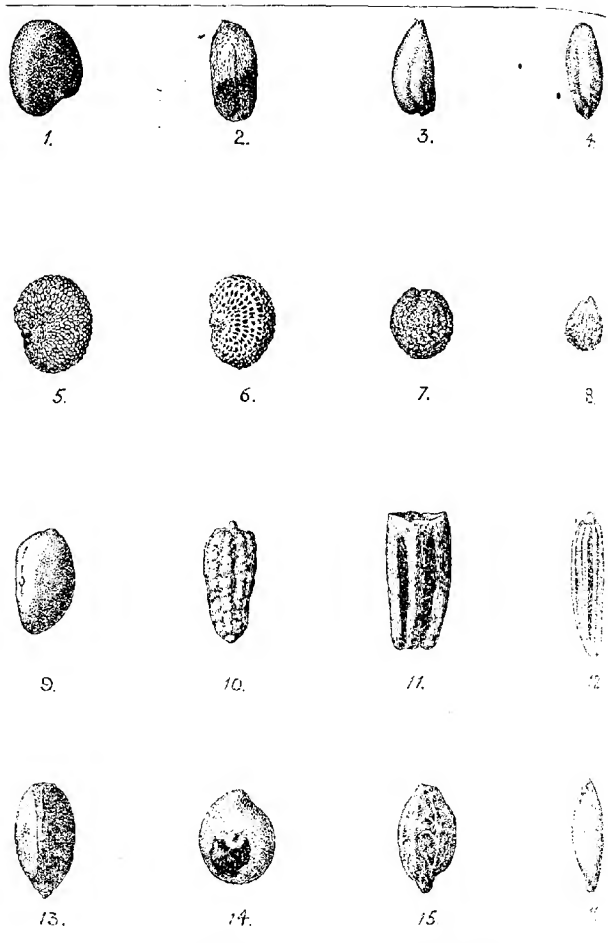

PLATE 2.—Seeds in Alsike Clover Samples, all × 10.

1. Alsike Clover (*Trifolium hybridum*).
2. Tumbling Mustard (*Sisymbrium altissimum*).
3. Treacle Mustard (*Erysimum cheiranthoides*).
4. Small-seeded False Flax (*Camelina microcarpa*).
5. Night-flowering Catchfly (*Silene noctiflora*).
6. White Campion (*Lychnis alba*).
7. Common Chickweed (*Stellaria media*).
8. Mouse-ear Chickweed (*Cerastium vulgatum*).
9. Dove's Foot Cranesbill (*Geranium molle*).
10. Stinking Mayweed (*Anthemis Cotula*).
11. Scentless Mayweed (*Matricaria inodora*).
12. Ox-eye Daisy (*Chrysanthemum Leucanthemum*).
13. Self-heal (*Prunella vulgaris*).
14. Fat Hen (*Chenopodium album*).
15. Sheep-sorrel (*Rumex Acetosella*).
16. Timothy grass (*Phleum pratense*).

Plantago lanceolata), and Mayweeds (*Anthemis* and *Matricaria* spp.).

Timothy, trefoil and white clover are frequent and sometimes abundant impurities of Alsike.

Agricultural Uses.—Alsike clover is not used to a very great extent in rotations; it is, however, considerably less susceptible to both eelworm disease and stem rot (*Sclerotinia trifoliorum*) than red clover; consequently in cases where clover leys are deemed to be essential even on " sick " land Alsike is to be preferred to red clover. When sown alone the usual seeding is about 8 to 12 lb. per acre. Pure Alsike or leys where Alsike predominates must be both grazed and fed green to stock with even greater care than red clover, particularly when it is in the flowering stage.

Alsike clover can be grown successfully under a wider range of soil and climatic conditions than can red clover; it withstands both acid conditions and excessive wet remarkably well and is considerably more winter-hardy than many strains of red clover. It can be grown to advantage under irrigation. Alsike clover is, therefore, a most valuable plant for use in seeds mixtures for leys on wet and waterlogged soil and, generally, for both rotations and longer leys at high elevations and in regions of high rainfall. In wet climates it has the further advantage that it may be cut for hay over a longer period than red clover. It should be included in seeds mixtures whenever there is any risk of a failure of " take " from the red clover, and thus on wet soils and in wet districts a few pounds of Alsike added to the red clover for even a one year ley would be in the nature of an insurance. Alsike and Timothy make a good combination for short duration leys on wet and heavy soils, while recently Alsike and cocksfoot have proved a successful combination on more normal soils. When Alsike is the only clover used for a short duration ley, from 5 to 7 lb. per acre should be employed. In more complicated mixtures for longer duration leys the amount usually varies from 1½ to 2½ lb per acre. It has been remarked that Alsike Clover has rather a similar growth habit to late-flowering red clover; these clovers are therefore to some extent mutually incompatible and are not both likely to do themselves justice when sown in large amounts in the same mixture. If and when late-flowering red clover is chiefly desired it is wisest only to include about 1 lb. of Alsike with 3 to 3½ lb. per acre of late-flowering red clover. This amount of Alsike will ensure some stand of clover if for

any reason the late-flowering red fails, without seriously hampering the development of the latter if a good "take" results.

The source of origin of the seed in relation to crop production does not appear to be of as great importance in the case of Alsike as of red clover, but this is a matter demanding further investigation.

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IMPROVEMENT OF POOR GRASS LAND IN EAST SUFFOLK.

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THERE is in East Suffolk poor grass land of the following quite distinct types, and, as far as possible, experimental plots have been laid down on all of them :—

(i) *Poor Heavy Land Grass.*—Probably a larger area of this exists than of any other type. Much of it is covered with thorns and the general tendency of this type of land is to grow whitethorn, unless it receives constant attention.

(ii) *Poor Mixed Soil Grass.*—There is not such a great area of this. A mixed soil is generally under tillage, for which purpose it is, under the climatic conditions of East Suffolk, much more suitable than for grass.

(iii) *Poor Light Land Grass.*—Much of this is hardly worthy of the name of grass land, as it produces practically nothing and may almost be described as derelict.

(iv) *The Marshes*, situated on the banks of the rivers, and near the sea. These vary much in type and are quite a distinctive feature of the grass land of the county.

Experimental plots on these various types of grass land may be considered in the above order.

1. **Poor Heavy Land.**—*Experiments at Saxmundham (Benhall) Experimental Station.*—The soil is a poor thin-skinned boulder clay. The field in which these experiments are conducted was nearly derelict twenty years ago, when taken over by the County Council. At the present time a field within twenty yards of the experimental field is still covered with bushes. Table I gives the manurial dressings applied and the yields of hay from the experimental plots.

Of special interest at the present time are Plots 3, 5, 6 and 7, which have received comparatively heavy dressings of superphosphate several times and which still maintain their yield. This shows that should it be proved that basic slag becomes shorter in quantity and inferior in quality in the future, heavy

land farmers in East Suffolk may rely upon getting good results on their pastures from superphosphate, provided that their land contains sufficient lime.

TABLE I.—*Poor Heavy Meadow Land (Saxmundham).*

Each plot $\frac{1}{4}$ acre except Plots 1A, 1B, 2A and 2B, which are $\frac{1}{8}$ acre.

Treatment. (The dates given are those on which the manurial dressing was applied).	*Yields of Hay.* 1919.	1920	1921.	1922.	Average 1902-1922 (grazed 1908).
	cwt.	cwt.	cwt.	cwt.	cwt.
1A. ½ cwt. basic slag, 1901, 1907, 1912, 1915-16, 1919-20 ...	14·2	21·5	16·5	25	24·6
1B. ½ cwt. basic slag, 1901, 1907, 1912. 1915-16. 1919-20, 2 cwt. kainit, 1909, 1912, 1915-16. 1919-20	15·5	26	18	27	26
2A. ½ cwt. basic slag, 1901, 1904, 1907, 1912, 1915-16, 1919-20 2 cwt. kainit, 1909, 1912, 1915-16, 1919-20	14	25	19	24·5	21·6
2B. ½ cwt. basic slag, 1901, 1904, 1907, 1912, 1915-16, 1919-20 2 cwt. kainit and 1 cwt. nitrate, 1909, 1912, 1915-16, 1919-20	14·6	26·5	16·5	24·5	22·8
3. 7 cwt. superphosphate, 1901, 1904, 1907, 1912, 1915-16, 1919-20	14	23	18	23·75	22·5
4. Unmanured	8	10·75	10·5	11·5	9·8
5. 7 cwt. superphosphate, 3½ cwt. kainit (1901, 1904, 1907, 1912, 1915-16, 1919-20)	14·6	29·5	18	25	24·3
6. 7 cwt. superphosphate, 10 cwt. lime (1901, 1904, 1907, 1912, 1915-16, 1919 20)	11·5	28·5	13·5	22·75	23·5
7. 7 cwt. superphosphate, 71 lb. sulphate of ammonia (1901, 1904, 1907, 1912, 1915-16, 1919-20)	15	29·5	14	27	25·4
8. 6 cwt. dissolved bone in (1901, 1904, 1907) 3½ cwt. bone meal in (1914, 1915-16, 1919-20)	13·4	24·25	13	22·5	21

NOTE.—1915-16, 1919-20 means the winter of 1915-1916, 1919-20.

Sheep Grazing Plots at Saxmundham (now arable).—Part of the area was manured with 10 cwt. of basic slag in 1904 and again in 1912, and the whole was grazed with sheep. The manured portion gave a profit, after paying for the manure, of 17s. 2d. per acre per annum over the period of years.

The land was ploughed up from grass and the following crops obtained per acre. The object of this experiment was to ascertain the improvement in the crops (if any) due to the residual effect of the basic slag upon the fertility of the soil :—

	1919. *Mixed Beans and Peas.*	1920. *Wheat.*	1921. *Barley.*	1922. *Mangolds.*
Plot 1. No manure on grass	29·7 bus. corn. 42 cwt. straw.	29½ bus. corn. 35 cwt. straw.	31½ bus. —	23 t. 15 cwt. —
Plot 2. 10 cwt. basic slag in 1904 and again in 1912	40 bus. corn. 62 cwt. straw.	38·8 bus. corn. 45 cwt. straw.	43½ bus. —	26 t. 10 cwt. —

The continued superiority of the slagged over the unslagged plot is undoubtedly due to wild white clover, which grew most luxuriantly on the slagged plot for years before it was ploughed up.

Park Farm, Shadingfield (Mr. G. Mitchell).—The field chosen adjoins the railway from Brampton to Beccles. The land was covered with thorns, the bushes being 10 to 12 ft. high, until the spring of 1920, when they were removed, and manures applied in March, 1920.

The following are observations on the plots made as a result of several inspections :—

Plot.

1. No manure.—Very poor.
2. 800 lb. 28 per cent. basic slag (containing 100 lb. phosphoric acid).—This has been a very good plot. The basic slag caused a great growth of wild white clover, with the consequence that the cattle have grazed it very closely.
3. 800 lb. 28 per cent basic slag (containing 100 lb. phosphoric acid). 224 lb. kainit.—Very good; similar to Plot 2. It is doubtful whether the additional application of kainit paid.
4. 370 lb. ground Algerian phosphate (containing 100 lb. phosphoric acid).—This plot is slightly better than the "No manure" plot, but is very inferior to Nos. 2, 3 and 5.
5. 728 lb. 30 per cent. superphosphate (containing 100 lb. phosphoric acid).—Very good; equal to Nos. 2 and 3. The effects of the superphosphate on this plot were visible in the season 1920, *i.e.* before the other manures had been given time to act.

When inspected on 7th May, 1923, Plots 2, 3 and 5 were still much better than Plots 1 and 4. Much more white clover was present, and it was also very interesting to observe that there

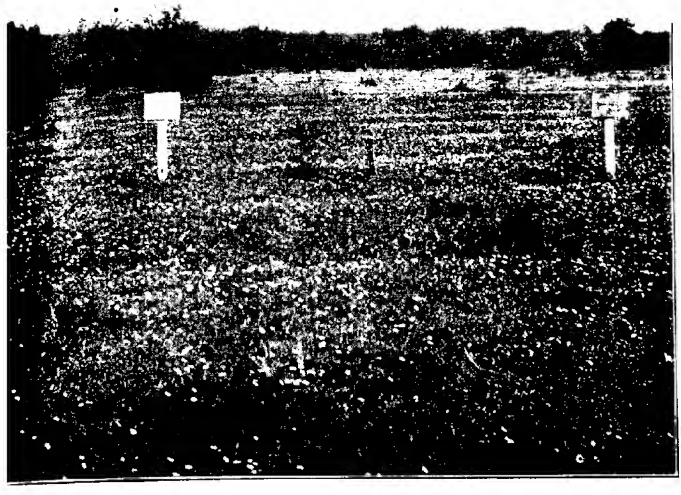

Fig. 1.- Shadingfield Plots. *Left*, No Manure ; *Right*, 800 lb. Basic Slag (160 lb. P_2O_5). The white flowers are daises, not White Clover, which will come on later.

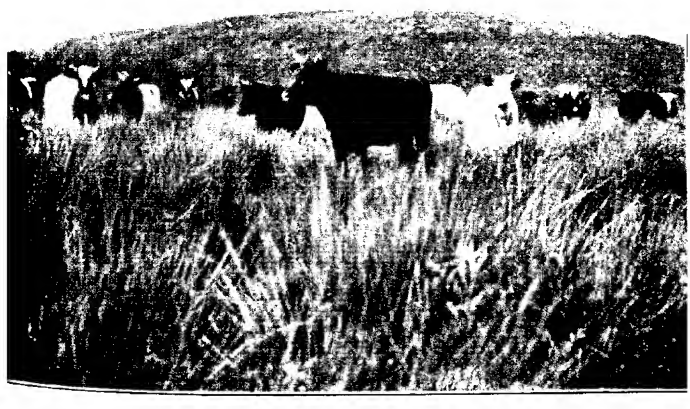

Fig. 2.—Showing the Rough, Marshy Grassland at Scots Hall, Westleton.

were far more daisies in flower on these plots on the day of inspection.

This soil contains chalk stones. Half of each plot was dressed with one ton of lime per acre, but this has not had much effect.

Marsh Farm, Ellbough, Beccles (Mr. Wm. Bullard).—The soil is poor heavy land. On 15th March, 1920, the same manures were applied as at Shadingfield, but they have not given such a good return up to the present as at that centre. During the autumn of 1922 the following observations were made:—

Plot.

1. No manure.—Poor and weedy.
2. 800 lb. basic slag (100 lb. phosphoric acid).—Clover, better grazed.
3. 800 lb. basic slag (100 lb. phosphoric acid), 224 lb. kainit.—A good deal of clover present, well grazed.
4. 370 lb. ground Algerian phosphate (100 lb. phosphoric acid).—Weedy.
5. 728 lb. 30 per cent. superphosphate (100 lb. phosphoric acid).—Much clover present, well grazed.

These plots were ploughed up during the winter, 1922-3, and the field sown with linseed in the spring of 1923.

Little Glemham, Saxmundham (A series of trials conducted at Mr. Kirkwood's expense).—Soil part heavy and part lighter. Mr. Kirkwood applied 7 cwt. per acre of 30 per cent. basic slag to certain parts of the Park in December, 1920; in other parts a similar dressing was applied of material known as slag phosphate, whilst small areas in various parts were untreated. When inspected by a party of farmers in June, 1922, part was being grazed, and part was intended for mowing. After a careful examination of the herbage in the grazed part, it was considered that the best pasture was found on the portion manured with slag in 1920. This contained a very large proportion of wild white clover. Compared with the unmanured part it was thought that the slag phosphate had done some good, but not so much as the basic slag.

The area reserved for hay was then examined, and it was found that where the basic slag had been applied in 1920 the crop was at least doubled and was of vastly better quality as compared with the "no manure" plot. Even basic slag applied in December, 1921, had already made a considerable improvement. The party were able to pick out the unmanured patches which had been left here and there, in most cases to within a yard, and the whole inspection formed an

object lesson in the extraordinary improvement caused by the application of basic slag to suitable land.

Lastly, a small area was inspected, which had received a dressing of farmyard manure, followed by a dressing of basic slag. This was being reserved for hay, and had produced a very heavy crop of beautiful herbage—in fact, the treatment was considered to be extremely suitable for this type of land when intended for hay, as the farmyard manure encourages the strong growing grasses, and the basic slag encourages the clovers.

2. **Poor Mixed Soil.**—*Corton County Council Small Holdings Estate (Mr. C. G. Cross).*—Manure applied in the winter of 1921-22.—The object of this test is, first, to ascertain the extent to which grass land of the poor mixed soil type can be improved, and secondly, what kind of dressing is likely to prove most successful. As regards the first point it was found that on all the manured plots a much larger proportion of clover was present. It seemed probable that the best plots were worth at least twice as much per acre, as far as actual feeding value was concerned, as were the unmanured plots.

As regards the effect of the various dressings applied, it might be explained that the dressings used were not heavy. They each contained phosphoric acid equal to 100 lb. per acre (*i.e.*, as much as is contained in 5 cwt. of high-grade basic slag). Four different kinds of basic slag were used—modern medium quality 24 per cent. slag, high-grade high-soluble Bessemer slag, open hearth high-soluble slag, and open hearth low-soluble slag. There were also included in the tests superphosphate, Gafsa (North African) rock phosphate, Nauru phosphate and the so-called "slag phosphate" which is a mixture of low quality basic slag and Nauru phosphate.

A careful examination of the plots in the autumn of 1922 showed that all the manures had done some good. It was observed, however, that all the plots receiving superphosphate and the highly soluble slags had been more closely grazed by the stock than others. On these plots, in fact, there was a carpet of white and red clover, quite close to the ground, and hardly any of the coarse and unpalatable grass, which was such a feature of the "no manure" plots.

It is just possible that this close grazing was partly accidental, but on the whole it seems probable that the more soluble manures had acted more quickly, and these plots had showed an improvement first. The cattle grazing the field would

quickly find this out, and would go for the sweeter plots, with the result that the coarse grasses would tend to disappear by the closer grazing. Many of the other plots had shown considerable improvement over the "no manure" plots, but they had not been quite so closely grazed. A further inspection in the spring, 1923, showed that the herbage on the "no manure" plots is strikingly inferior to the rest of the field.

3. **Light Mixed Soil.**—*Woodbridge* (*Mr. G. Barnardiston*).—Mr. Barnardiston very kindly offered to conduct at his own cost a series of plots on a field adjoining his house at Woodbridge. Basic slag alone, basic slag with kainit, superphosphate alone, superphosphate with kainit, and North African phosphate were tried. Each plot received manure costing £1 13s. 9d. per acre in the winter of 1921-22.

The land is of a difficult type on which to encourage the growth of wild white clover, especially with such weather conditions as prevailed in the early months of 1922. When inspected in June, none of the plots showed much evidence of improvement. It is worthy of note that the improvement of pasture land almost entirely depends on the growth of wild white clover, and this can only take place providing sufficient moisture is present. For this reason the improvement of grass on light mixed soil is a difficult matter.

4. **Marshland.**—*Scots Hall, Westleton* (*Mr. J. W. Rickeard*).—Manures sown November, 1921. The marshes are adjoining the sea. In each case the manures were arranged to cost £1 13s. 9d. per acre at the time of sowing.

Plot.

1. 11¼ cwt. basic slag (92 lb. phosphoric acid).
2. 6¾ cwt. basic slag (55 lb. phosphoric acid), 3¾ cwt. kainit.
3. 7½ cwt. superphosphate (115 lb. phosphoric acid).
4. 4½ cwt. superphosphate (69 lb. phosphoric acid), 3¾ cwt. kainit.
5. 333 lb. Nauru phosphate (137 lb. phosphoric acid).
6. 4½ cwt. slag phosphate (115 lb. phosphoric acid).

The marsh was covered with small rushes and is rather wet. During the summer of 1922, a great improvement was to be seen on some of the plots, and large quantities of wild white clover and wild red clover grew up amongst the rushes to a height of several inches.

After a rather prolonged examination of the plots, the party of inspection during the summer came to the conclusion that Plot No. 1 was the best. This plot showed a great improvement over the adjoining land which was unmanured. The wild white

clover and wild red clover were growing up amongst the inferior herbage in a most encouraging manner and the weight of the crop on this plot was estimated to be double that on the "no manure" plot.

The second best plot was thought to be No. 3, which received 7½ cwt. of 30 per cent. superphosphate. This plot also contained a large proportion of white and red clover, and showed that should our sources of basic slag fail us, superphosphate would answer extremely well, on even such unpromising places as the marshes. The third and fourth plots in order of merit, as judged by appearances, were No. 2 and No. 4. Plots 5 and 6 were distinctly better than the "no manure" plot.

Sanders Hill Marsh, Scots Hall, Westleton.—The manuring per acre was as follows:—

Plot.

1. 11¼ cwt. basic slag.
2. 6¾ cwt. basic slag and 3¾ cwt. kainit.
3. 7½ cwt. superphosphate.
4. No manure.
5. 4½ cwt. superphosphate and 3¾ cwt. kainit.
6. 363 lb. Nauru phosphate.
7. 4½ cwt. slag phosphate.

The grazing marsh was selected because of the extreme coarseness of the herbage, which consists largely of sedges, rushes, and wild iris, growing 2 ft. or so in length. A careful examination in June, 1922, however, revealed the presence of wild white clover, with large leaves at the end of long leaf stalks which had grown to an unusual height in order to enable the leaves to reach the light. The various manures given above had been applied to this most unpromising herbage, and it was thought that both the basic slag and superphosphate had made some improvement. It was considered, however, that the wild white clover had not a chance to develop properly owing to the heavy top-growth. Mr. Rickeard now proposes to keep the top-growth cut off. When inspected at the end of November, 1922, the whole had been cut and grazed quite closely. These plots should prove very interesting during the coming season.

Marshes, Hall Farm, Rushmere, Lowestoft (Mr. John Oldrin).—This marsh land is on the banks of the Hundred River. The soil is a sandy peat evidently containing a large proportion of vegetable matter. At present a considerable proportion of the herbage consists of rushes, and Mr. Oldrin has been trying the interesting experiment of running a plough with

a wide share, with a special wing attached, to cut 14 in. wide under the turf. The breast is removed from the plough and the turf is allowed to fall back to the place from which it was cut, and is then rolled down. A careful examination by a party of farmers in July, 1922, of the strips treated in this way showed that they contained a considerably smaller proportion of rushes, even when three years had elapsed since the treatment. In the case of land similarly treated in the autumn of 1921 it appeared that the bulk of the herbage was slightly reduced but the quality was improved. The strips of land were cross-dressed with various manures so that it was possible to observe the effect of the manures both on the ploughed and unploughed portions.

It had been arranged that each manured plot should receive manure costing £1 13s. 9d. per acre. The manure was not applied until March, 1922, so that the slower-acting manures had not had time to act. A careful examination of the herbage led to the conclusion that all the manures had done some good, when compared with the "no manure" plot. In all probability the two best plots were No. 3 receiving 7½ cwt. 30 per cent. superphosphate per acre, and No. 5 receiving 4½ cwt. 30 per cent. superphosphate and 3¾ cwt. of kainit per acre. Most members of the party considered that No. 5 was slightly the better. Certainly the weight and quality of the herbage on these two plots had been very considerably increased. Of the remaining plots, No. 1 which received 11¼ cwt. 16 per cent. basic slag, and No. 2 which received 6¾ cwt. 16 per cent. basic slag and 3¾ cwt. kainit per acre were decidedly better than the "no manure" plot although, having been applied in the spring, the basic slag had not had time to act properly. Plots No. 6 which received 363 lb. of Nauru phosphate and No. 7 which received 4½ cwt. slag phosphate per acre, were also considered better than the "no manure" plot, although the dressings also had not had time to act. The plots should be very interesting in 1923 and 1924.

On the whole it would appear that much improvement of marsh land of this type can be effected by the application of superphosphate or basic slag, and that clover can be encouraged to grow in a really surprising manner by the use of these manures. In the case of sandy peat, it may pay to add some kainit, sylvinite or other potash manure to the phosphatic manure, but that is a matter to be tested in each case.

Marshland at Trimley (Mr. C. C. Smith).—These marshes differ from many Suffolk marshes in that the soil is covered by a thick mat of undecayed vegetable matter. In some places this mat is two or three inches thick, and it is only soaked by rain with great difficulty. About ten years ago a number of plots were laid out by Mr. Smith at his own expense on the two marshes. The manures used included farmyard manure, basic slag alone and in combination with muriate of potash, superphosphate alone and in combination with muriate of potash and ground lime. Ground lime was also used alone.

On the first marsh some improvement was evident where the phosphatic manures were applied. None of the manures succeeded in getting rid of the thick mat of vegetable matter, although they encouraged the growth of clover to some extent. On the far marsh where the mat of vegetable matter is very thick, the improvement was not so great as on the first marsh.

The problem of getting rid of the thick mat of vegetable matter is, therefore, at present unsolved, and Mr. Smith proposes to try other methods and applications in order to see whether it is possible to effect a greater improvement in these marshes.

Dr. J. A. Hanley, of Leeds University, who inspected these marshes in June, 1922, thinks that a dressing of crag or chalk, would greatly benefit them, as the thick mat of vegetable matter is, in his opinion, due to lack of lime.

Lyons Farm, Bulcamp (Mr. W. C. Mitchell, Agent).—The cost of this experiment was borne by the Earl of Stradbroke. The soil is black, containing much vegetable matter, the herbage being largely rushes. The original experiment was started on the marsh near Bulcamp Workhouse in March, 1920.

The following observations were made after an inspection by farmers in June, 1922:—

Plot.

1. No manure.—Very poor, and full of rushes.
2. 800 lb. 28 per cent. basic slag (100 lb. phosphoric acid).—A great improvement; much clover present.
3. 800 lb. 28 per cent. basic slag, 224 lb. kainit.—A great improvement; much clover present.
4. 728 lb. 30 per cent. superphosphate (100 lb. phosphoric acid).—A great improvement; much clover present. This plot showed improvement first.
5. 370 lb. ground rock phosphate.—Very little better than the "no manure" plot in 1921. Improved in 1922.

The plots were cross-dressed with 1 ton of lime per acre, but this has not done much good up to the present.

A meeting of farmers was held on these plots in 1921, and they considered the results extremely interesting, and at their request a further experiment was arranged on an adjoining marsh, the manure being applied during the winter 1921-22. This second series of plots was inspected in June, 1922, when it was found that some of them contained a perfect carpet of white clover several inches deep. The best plots were those receiving basic slag, basic slag and kainit, superphosphate, and superphosphate with kainit. All this latter series of plots received 150 lb. of phosphoric acid per acre. These plots should prove an interesting study for some years.

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THE HILL SHEEP FARMS OF NORTHUMBERLAND.

J. ROBSON.

THESE farms occupy practically all the land lying between 500 ft. above sea level and the top of Cheviot, which stands at 2,676 ft. All kinds of weather are met with. An old saying is: "Little kens the guid wife of the trows how the wind blaws on Windy Gill." If there is such a variety of weather on one farm, one can understand the changes which are encountered between the Durham boundary and the North Sea. A variety of herbage is met with, heather, flow and bent predominating south of the North Tyne, but further north finer grasses are sometimes found. As I am not a botanist, I cannot describe all the plants which comprise a good hill pasture, but the more it is mixed, the better it is counted. The deeper the soil, the bigger the sheep it will produce; and there must be a certain amount of fine grass along the burn sides to make big fat lambs.

There ought also to be a small proportion of heather to provide a change of meat and a healthful tonic, also some flow ground on which the draw-moss (*Eriophorum vaginatum*, L.) and deer's-hair (*Elecocharis cæspitosa*, Link) grow. If the "Flows" lie fairly low so that stock are not prevented grazing on them in stormy weather, their situation is ideal. There can be too much of a good thing, and though too much mowing makes for waste land, a little is invaluable.

In a really bad spring stool bent (*Juncus squarrosus*, L.) is often

the only green thing that can be found, and a little of it comes in very useful for the flock. However, it is generally found on hard, bare land, and too much is not desirable.

White Bent (*Molinia cærulea*) is unfortunately too common. Its life as a food is so short that it is only available for sheep for about three months. Thus one scarcely ever sees it on a good farm. It is greatly benefited, and its useful life prolonged, through heavy eating by cattle, but as it can only be stocked with them in June, and they should be away by September, it is scarcely a profitable business buying them for that short period, especially as that is the time when grass everywhere is generally most plentiful.

Breeds.—Only two breeds of sheep are found, the Cheviot, indigenous to the district, and the Blackface. The former was thought so much of that in 1703, Sir John Sinclair, when taking sheep to the North of Scotland, came to Northumberland for a selection. A century ago, Blackfaces were unknown in the county, but with the demand for younger mutton, and the low price of wool combined with a run of bad seasons, this breed began to replace the Cheviot, till now they are perhaps as numerous.

Stocking.—The farms range from 500 to 10,000 acres with a sheep stock of 100 to over 3,000. On an average a shepherd will have a "hirsel" of 600 sheep, and his "hill" will extend to anything from 500 to 2,000 acres. One sheep to the acre is usual on the better land, but as much as three acres per sheep may be required on the poorer grazings.

Formerly shepherds were paid "pack" wages, that is, they were allowed to keep so many sheep, from fifty upwards, along with the employer's, and the increment from them was his wage, but packs are very scarce now, and the shepherds are generally paid in cash, with a free house, potatoes, coals carried free, and the keep of two cows. The pack system caused a good deal of extra labour in sorting, all the pack sheep having to be sorted by themselves. Of course, this was payment by results, but just as much care is taken one way as the other, and in fact the only shepherd who ever left the writer in the lurch had a pack wage and left his own sheep behind.

Management.—The management of the two breeds is practically the same, so one description will do for both. We will take the season as beginning about 20th November, when the tups are put out, one tup to 60 or 70 ewes, and during the

time they are out, about ten weeks, the ewes are gathered to each tup. A few extra tups should always be provided to replace any that go wrong. About the New Year they are brought in, and usually sent away to turnips, unless these are grown on the farm. After that, should the weather be favourable, is the shepherd's easiest time, as less herding is required then than at any other season. The shepherd must always be on the alert in case a sudden snowstorm should arise, when the sheep must be gathered to the stells. This may be a very trying time, as, if the flock be caught out, it is very hard work indeed getting them collected, so much so that some men have become so exhausted that they have succumbed to the exposure.

That sheep farming is not all beer and skittles was proved by the spring of 1917, when in spite of every attention thousands of sheep were lost. The year 1860 was also a disastrous one; on one of the best hill farms in the county only 220 lambs were weaned from 1,400 ewes. The "eighties," also, took a heavy toll from border farmers.

Calamities such as these leave their mark for many years, not only on the bank balances of the stock owners, but also on the stamina of their sheep, for the survivors, though no doubt the strongest, suffer in hardihood.

A bad lambing time, too, by causing a short crop of lambs, compels farmers to retain as breeding stock many smaller and poorer lambs which in the ordinary course would have been drafted.

A snowstorm is a great test of a shepherd's ability, as some men have the knack of looking after their flocks so that they exist much longer without hay than others can. In such seasons the shepherd's work is arduous as well as disappointing, for in spite of all he can do, his charges deteriorate in condition. When hay is required there should be a daily allowance to each score of sheep of about a stone of the best hay scattered on a piece of well-sheltered ground which should be changed as often as possible. On some farms, benty or grassy ones as a rule, once haying is commenced it is continued as long as it is eaten. In this case it is given in hicks or nets, and care should be taken that the sheep are not allowed to lie about the nets after they have eaten up the hay. As the season wears on a sharp look-out must be kept for any lean sheep, and these should be brought into the fields or sent away to better grass. About the beginning of April it is customary on some farms to udderlock

all the ewes as it is thought that the lambs suck more readily and there is less danger of the lambs getting wool in their stomachs.

With such flocks ewes are lambed on the hill, and not brought into enclosures as in other parts. Lambing begins about mid-April, and each shepherd is generally provided with a lambing man whose assistance he has for a month. Before he leaves, the lambs should be marked, their tails cut, and the wedder lambs castrated, those intended for tups having been selected first. Castration can be done in many ways. The oldest and simplest is by the knife, the other of the more commonly practised methods being by the clamps and a hot iron. In the latter case the operation is generally deferred till the end of June and is commonly practised on "diseased" farms. At the end of June sheep are washed by being swum through a pool a few times, but Blackfaces are seldom washed, and many Cheviots are now clipped in the grease. Clipping takes place in July—Cheviots about the beginning, Blackfaces later. This should be carefully done, the wool nicely trimmed and the fleeces neatly tied by ropes made by twisting a piece of the fleece.

On the eastern borders, Cheviot ewe lambs for stock are weaned about the end of July and sent to their hogging where they stay for two years and are then brought to the ewe "hirsels" to take the place of the ewes sold as drafts at five years old. Further west and amongst Blackfaces, the keeping ewe lambs generally follow their mothers and have lambs a year younger—at two years. The wedder lambs are sold at the auction marts at the end of August and are bought by feeders to be fed off. Blackfaces are often sent straight to the butcher, and many who practice this method do not cut their lambs but sell them as tups in August and early September. If kept, they should be cut later.

The summer dipping should be done in August and a fly dip is generally used at this time. Cheviot draft ewes should be dressed and brought out in as good form as possible for the draft ewe sales held early in October. Blackfaces should be dipped in a bloom dip and brushed up, not dressed like Cheviots. As soon as the drafts are away, the second dip should be used. After this, dosing the hoggs, if it is practised, is the next work, and we complete our cycle with heeling—marking with a coloured paint, at which period it is advisable to select the best ewes to put to the best tups obtainable.

During the whole year a constant lookout should be kept for lame sheep and any showing the least symptoms of lameness brought in, the feet pared, and dressed with a good paste. After dipping, some flockmasters drive their sheep through a footrot trough containing a mixture of a proprietary article, arsenic, or bluestone; this is a great preventive of footrot, but should not take the place of the foot dressing previously mentioned.

Maggot flies are much more troublesome now than they used to be, and a constant watch should be kept for them. If very bad, dipping the whole flock is advisable, as for a time it keeps the fly off.

If the shepherd takes a real interest in his flock, his duties, though necessarily of a routine character, can never be monotonous, as such work certainly would be to anyone who simply did it for his daily bread. To rise at daybreak, climb to the top of a hill, often rising one thousand feet above his cottage, turn his sheep in, then come back above them again to see that none are left lying back or are amiss in any way, may mean a walk of six to ten miles—determined by the extent of ground which comprises his "hirsel." His time is then his own—unless he finds some of his flock require special attention—till the afternoon, when he takes a turn round the lower part of his ground, turning his flock out so that they go to the hill tops for the night, except in stormy weather, when they are allowed to lie on the lower and more sheltered parts. A good shepherd should, as we are told, know his sheep, and although I am doubtful if the sheep know him, they certainly know his dogs, as anyone can see who takes strange dogs amongst them.

Shepherds have generally to help at hay time, so that season is a hard one for them, having their sheep to watch and also to be in the hayfield when hay-making is possible.

* * * * * *

ELECTRO-CULTURE WORK IN 1922 AND 1923.

THE following account of work on electro-culture, carried out in 1922 and to be carried out in 1923, is summarised from the Fifth Interim Report of the Ministry's Electro-culture Committee, which has recently been presented.* The previous work

* This report will not be published, but copies may be obtained on application to the Secretary of the Committee, Mr. W. R. Black, B.Sc., Ministry of Agriculture, 10, Whitehall Place, London, S.W.1.

of this Committee was summarised in this *Journal* for December, 1922, p. 792.

During 1922 field experiments were carried out for the Committee by Prof. V. H. Blackman as follows:—*Rothamsted Experimental Station*—Experiments with winter wheat and barley; *Harper Adams Agricultural College*—Experiments with cabbages, swedes, mangolds and potatoes; *Lincluden*—An experiment with potatoes. An economic installation was erected at Rothamsted. Pot-culture experiments with barley were continued at Rothamsted. Laboratory investigations were conducted at the Imperial College of Science. Electrical measurements were made to determine the influence of an electro-culture installation on the electrical conditions to leeward and windward.

Field Experiments in 1922.—Seven experiments were carried out during the year, two with cereals, two with potatoes, two with root crops and one with cabbages; two of these gave a positive result and five a negative result. The season was not a favourable one for experimental purposes, the yields of the cereals being abnormally low, that of wheat being only about half the average. In the case of the root and cabbage crops, owing to the doubt which exists as to the satisfactory nature of the cultural conditions, the Committee are of opinion that no safe conclusions can be drawn from the experiments, and that the results should not be included in future records.

For an account of the field experiments in detail reference must be made to the Committee's Report.

Pot-Culture Experiments of 1922.—Ten experiments were carried out with barley in 1922 and were mainly designed to obtain further knowledge as to the stage of plant growth during which the discharge can most advantageously be given, and the most suitable daily duration of the discharge. An experiment was also carried out to determine the effect of the normal atmospheric current. In all the experiments grain yields as well as total yields were obtained.

The discharge was applied (in different experiments) in the first month, the second month, and the third month of the growing season respectively, and also throughout the whole three months; in the case of each period the discharge was applied (in different experiments) for six hours and also for one hour daily.

Definite increases of yield were obtained in all the experiments but one, in which the plants were attacked by mildew. The increases in dry weight reached 39 per cent. in one experiment, but in other cases were quite small. In all cases, however, with

the exception already mentioned, very marked increases in *grain* yield were obtained, reaching even 118 per cent., and these large increases in grain yield were usually associated with very small increases in total yield. The effect is so marked that it establishes a differential action of the discharge—that of accelerating reproductive growth apart from vegetative growth, an effect hitherto unsuspected.

Another striking result was the marked effect on grain yields of comparatively short periods of discharge. Electrification for the first, second and third month, respectively, of the growing season gave in all cases large increases of grain, the second monthly period being the highest of the series with a yield more than double that of plants not subjected to the discharge. How far such a large increase may be expected in other seasons remains to be determined.

In one experiment plants were subjected to a discharge of a lower intensity than any hitherto employed, the current being only about 100 times the value of the normal atmospheric current. This current, which was continued for the full period, was apparently as effective as the stronger current, except in the case of plants electrified for the second month.

The removal of plants from the influence of the normal atmospheric current was accompanied by a slight reduction in yield.

The pot experiments are referred to in detail in the Committee's Report.

Economic Installation at Rothamsted.—A field installation was erected on Fosters Field at Rothamsted in 1922 on an economic scale (*i.e.*, with poles spaced widely, and with high wires, so that no undue interference was caused to farming operations), the object being to determine the kind of installation suitable for the purpose, the current required, and the cost.

The area under the influence of this installation (assuming the discharge to be effective for 15 ft. beyond the wires on all four sides) is about 5 acres. The installation consists of 9 creosoted poles each 24 ft. in length, of which 6 ft. is sunk in the ground: 4 of the poles are in the field and 5 in the hedges. The supporting wires at the ends of the area and in the middle of the area are of rustless mild steel (No. 12) each 125-150 yards long. There are 12 thinner wires (No. 26) of silicium bronze, each 200 yards long. The porcelain rod insulators are 18 in. long. The cost of the installation and its erection (materials, carriage, labour, travelling expenses and supervision) was £52, or about £10 per acre.

The Agricultural Electric Discharge Company have supplied the Committee with estimates of the cost of erection of an economic installation in areas of various sizes. The cost of the poles, insulators, and wires for 100 acres is £215, *i.e.*, slightly over £2 per acre, so that it is obvious that the price for small installations is no criterion of the cost in actual practice. The fact that fields are not of the size of 100 acres hardly affects the question since several fields can be included in one installation.

Electrical Measurements, 1922.—The measurements were taken at Rothamsted (1) on the wheat plot, (2) on the stubble after the wheat crop was removed, and (3) on the field under the economic installation.

Before these experiments doubt might well be entertained whether even a rough estimate of the current passing to the crop could be derived from the measurements of the current passed into the overhead wires. It now seems fairly certain, however, that with overhead wires whose distance apart is not much in excess of their height, fully half the current supplied to the wires may be expected to reach the crop. It is also clear that a very considerable area surrounding the electro-culture area, especially on its leeward side, receives a discharge much in excess of that which passes normally between air and earth.

The Committee's Work in 1923.—The results obtained in 1922 indicated the importance of concentrating attention on pot-culture experiments, small plot experiments and laboratory work. The experiments of 1922 on the effect of the discharge during different growing periods and different daily periods are being repeated in 1923; the effect of very weak currents and the effect of screening the plants from the normal atmospheric current are again being studied.

The results obtained from pot experiments are not always reproduced in the field owing to the effect of subsoil and other factors. Small plot experiments are, therefore, being carried out at Rothamsted and Lincluden for comparison with the results of the pot-culture experiments; the discharge is being applied for three different periods:—one, two, and three months respectively.

The economic installation at Rothamsted is being used for crop electrification, and measurements will also be made of the electrical conditions in and under that installation.

It has been found that the effect of the current is greater a short time after the application of the discharge has ceased than during the period of the discharge. Laboratory experiments are therefore being carried out to ascertain the minimum period of

electrical stimulation giving the greatest after effect as exhibited by an increase in the rate of growth.

Work on a field scale is being suspended during 1923, except for small plot work and the collection of data from the economic installation.

The results obtained from pot-culture work in 1922 are important, *inter alia*, from the point of view of the installation required on an economic scale. If it were necessary to apply the discharge for one month only, a very temporary installation could possibly be used, with consequent reduction in cost. Different fields could possibly be treated with the same installation. With lower heights of wires a lower voltage would suffice, and it might even be possible to apply the discharge by means of apparatus comparable to a "Knapsack Sprayer" or some ordinary agricultural implement. The Committee are keeping this aspect of the question in view.

Future Work of the Committee.—It is clear that the electro-culture problem is an intricate one with both physiological and agricultural aspects, and one which is far from being fully elucidated. The Committee's investigations, however, may be fraught with the most important consequences to agriculture as the results hitherto attained clearly indicate.

By a series of field experiments spread over a number of years the Committee have shown the type of electrical apparatus most suitable for the production of the high-tension discharge and have also shown that an increase of 20 per cent. can be obtained with certain cereal crops. That such results should have been obtained is very striking when the poverty of our knowledge of the conditions under which the electric discharge should be applied is taken into consideration. The Committee hold that a study, by laboratory and pot-culture methods, of the effect of the discharge at different stages of the plant's growth, of the effect of different daily periods of discharge, and of different strengths of current, will throw much light on the proper conditions under which the discharge should be given in the field. The Committee are confirmed in the view by the remarkable results obtained in 1922 when in pot-culture experiments an increase of 118 per cent. was obtained with only a single month's electrification.

Such results as these are of very great promise, for if lesser increases of 40 or 50 per cent. can be obtained in the field there can be no question of the economic application of electro-culture. The Committee therefore propose in the year 1924 as in 1923 to

confine the work to pot-culture and small plot experiments, and to laboratory investigations. It is proposed, however, that in 1925 field experiments shall again be undertaken on the basis of the scientific knowledge acquired in the previous years. The Committee expect by the end of 1925 to have made very definite progress in knowledge of electro-culture, and a definite advance towards its practical application.

The Committee understand that a period of 20 years was required to complete the investigation into a systematic application of fertilisers. The electrical problem appears to be even more complex, but from the results already obtained the Committee believe that positive and economic conclusions will be reached within a much shorter period than the problem of fertilisers required if investigations are carried on continuously.

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GRADE "A" MILK—IS IT WORTH WHILE?

F. A. Cox.

In the hope that the matter may be of interest to others who feel inclined to embark on the same procedure, an attempt has been made to give here a description of the alterations in equipment and methods on my farm near Oxford, which has recently diverted its energies from the production of ordinary to Grade A (tuberculin-tested) milk.

To begin with, our experience of the tuberculin tests may be interesting, perhaps encouraging, to others. Two reactors only, in a test of twenty-five, were found on the first occasion, and six months later a purchased heifer reacted to the eye test. These animals have been removed. This result, it will be agreed, was highly satisfactory, and we were then well prepared to proceed with the necessary modification of the buildings, a description of which follows.

Milk Room.—Methods under the old system were probably similar to those obtaining on a good many farms. Cooling was done in the scullery attached to the farm house. This state of affairs obviously could not continue. Cooling and washing up needed to be done in a separate building, and accommodation found for a steam boiler for sterilising purposes. Before anything was decided on, it was considered advisable to see the arrangements existing on other farms, and a visit was paid, under the auspices of the National Institute for Research in

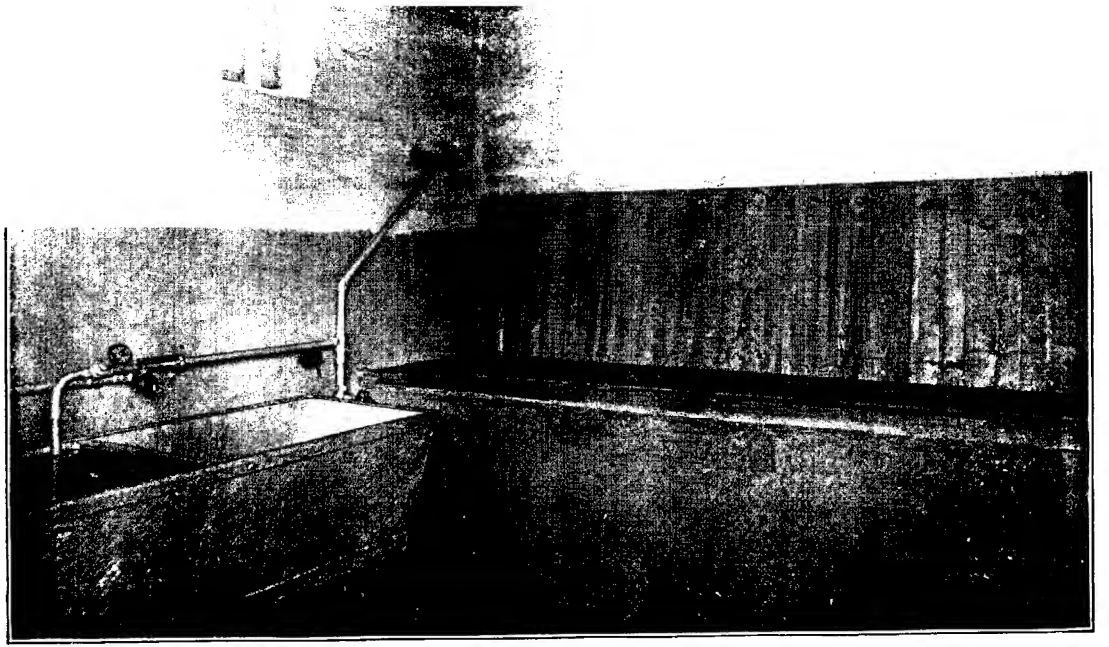

FIG. 5.—Interior View of Dairy showing Washing and Sterilising Arrangements.

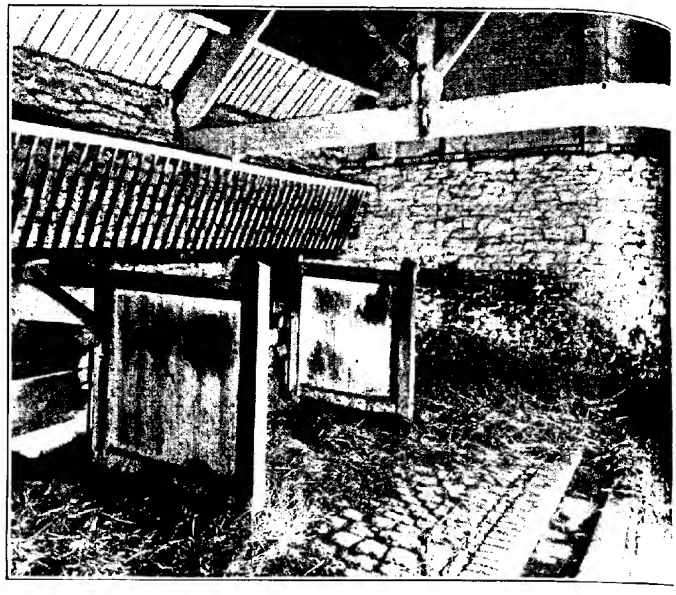

FIG. 6.—Showing the Interior of Shed before Re-construction.

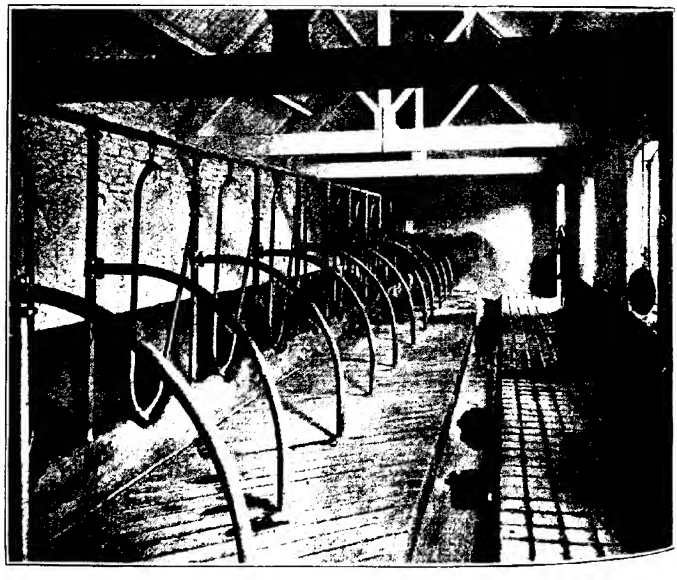

FIG. 7.—Interior of Shed after Re-construction.

Dairying, to those near Reading described by Major H. P. Maule last year.*

After looking round for a suitable building for conversion into a milk room, it was decided to commandeer the domestic coalhouse—at first sight a most uninviting place. Imagine a substantial stone building practically devoid of light and measuring inside 15 ft. by 8 ft. 6 in. Fig. 1 is a plan showing details of the alteration made here. Glass slates in the north side of the roof were the easiest solution of the lighting difficulty. A concrete floor was laid, and a slab partition put up dividing the building into two rooms approximately 7 ft. 6 in. by 8 ft. 6 in. That with direct external access was fitted up as a washing and sterilising room. Fig. 5 shows the equipment of this room, with washing up trough and steriliser, with the necessary steam and water fittings. The steriliser is of a new type, built of brick cement plastered, and fitted with a wooden lid. A drainage hole is situated at the bottom, and no attempt has been made to make the steriliser steam-tight. Dimensions are 7 ft. 6 in. long by 2 ft. wide by 3 ft. high, giving ample room for about five twelve-gallon churns and cooler, buckets, filter, etc., at once. This steriliser, besides being inexpensive, has proved very efficient, no difficulty having been experienced in getting the necessary temperature of 210° F.

The other room was fitted up for cooling purposes, the cooler being supported on irons let into the wall. A bucket rack of galvanised pipe was fitted, but is little used, as it is found more convenient and satisfactory to leave the utensils in the steriliser till required.

All walls were cement plastered to a height of 5 ft., the roof covered with match-boarding, and angles between wall and floor rounded out. Whitewashed walls and the provision of a drain completed the necessary work here.

The boiler (Fig. 1) is housed some distance from the milk room, being connected thereto by some 40 ft. of pipe, lagged to prevent loss of heat. The building housing the boiler is a hog-tub house, an old copper being removed to make room, and the boiler is available for steaming pigs' food as well as sterilising, if necessary. The boiler was obtained cheap locally, this fact enabling us to keep the cost of the milk room and sterilising equipment down to the reasonable figure of about £60.

Cowshed.—This is situated some twenty yards from the milk room. Fig. 6 shows the appearance of the old shed, Fig. 3

* This *Journal*, Sept., 1922.

being a section of the same place. It had few redeeming features, with the exception of the fact that the building itself was substantial and sound. Cobble floor, high mangers, standing too long, insufficient lighting, bad drainage, are all objectionable. Fig. 7 shows the shed after alteration, the dimensions being given in Figs. 2 and 4. The roof is of double Roman tiles, and glass tiles of the same section were readily obtained and formed an easy means of improving the lighting. Some thought had to be expended on Fig. 4 before satisfactory dimensions were arrived at, the shed being a rather narrow one

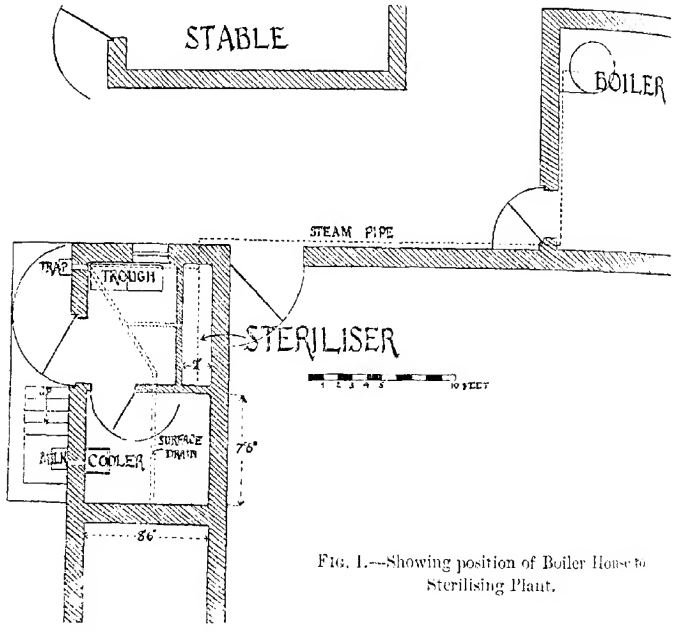

FIG. 1.—Showing position of Boiler House to Sterilising Plant.

(15 ft. only), for the inclusion of a feeding passage. Had more room been available the gutter would have been 2 ft. instead of 14 in., and the manger 3 ft., as we find the cows are inclined to drop some food over the manger back into the passage. The fittings used are British and cost £2 10s. per cow. The mangers are built up of slabs, cement plastered, and the divisions have an opening at bottom to permit of flushing the whole range from end to end. All angles in floor and manger are rounded out to provide no lodgment for dirt, and the back wall is cement plastered to a height of about 3 ft. to facilitate cleaning.

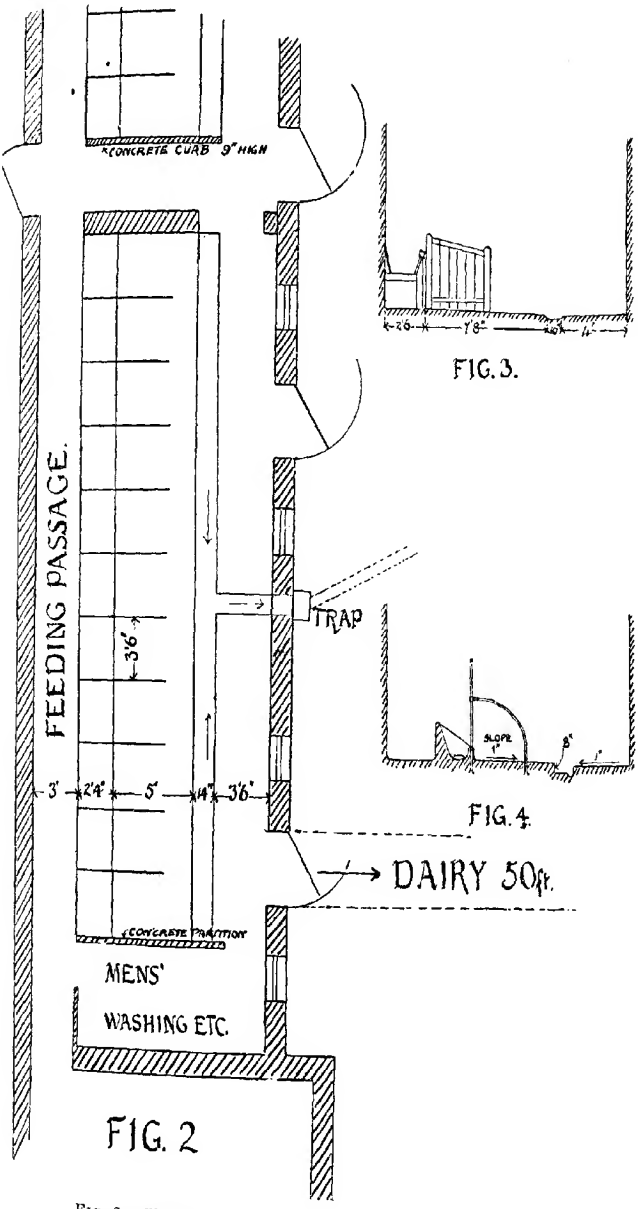

FIG. 2.—Plan of re-constructed Shed.
" 3.—Section of Cowshed before re-construction.
" 4.— " " after "

Ordinary farm labour only was used throughout this work, and while the appearance may not be equal to that of the best professional work, the result is quite satisfactory. Unfortunately no account was kept of time put in on the work, but as near as can be estimated the total cost, including fittings, of conversion of this shed was approximately £5 10s. per cow, a very reasonable figure.

Fig. 2 also shows the arrangement that is being adopted to provide accommodation for milking suits and for washing men's hands: two stalls at the top end of the shed are dispensed with, a partition dividing this portion from the remainder of the shed.

Drainage of these buildings was a comparatively simple matter, as a system of sorts was already in existence, and also a liquid manure tank. This system was overhauled and new drains from the cowshed and milk room were connected to it. All drains passed through the wall into a suitable trap outside.

In conclusion, a few remarks on the practical aspect of the production of Grade A milk will not be out of place. It is recognised that the cost of production is greater than that of ordinary milk. Certain charges cannot be avoided, such as interest on capital outlay in conversion, veterinary surgeon's account, etc., but actual running expenses can be kept down by careful management. For example, with a slight readjustment of labour it has been found possible to produce Grade A milk from this herd of some 20 cows without any increase of staff. A small amount of extra time is involved, which would mean, roughly, 5 men, or 4 men and a boy, where 4 men sufficed under the old conditions. It has always been the practice on this farm to wash the cows' udders, and we find in the new shed that the cows, when lying in, keep themselves much cleaner than previously, and little labour is required in cleaning them.

Economy in boiler fuel is possible by the method adopted here. Utensils are washed in cold water after the morning milking. The boiler fire is lit about 11.30, and steam is usually available after the dinner hour, when the utensils are thoroughly scoured, rinsed and steamed. The fire is then damped down to keep the boiler in readiness for the afternoon steaming. By this means the boiler is only hot for 6 hours a day and fuel consumption is kept at a minimum.

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STRAW ROPES AND STRAW ENVELOPES—THEIR MANUFACTURE AND USES.

Communicated by the Rural Industries Intelligence Bureau, 258, Westminster Bridge Road, London, S.E.1, where reprints can be obtained.

A DESCRIPTION of some of the industrial uses to which straw is put and the methods adopted in preparing it, may be of interest to many, who perhaps have not realised the importance of straw to a number of different trades. The practical economy of any process which will increase the value of the raw article and which at the same time should make it both easily marketable and provide useful employment in the country will be quite apparent.

I. STRAW ROPE.—Of the two processes to be dealt with in these notes, the production of straw rope is simpler, perhaps more remunerative and better suited for unskilled labour than the manufacture of straw envelopes.

A. Its Uses.—1. *As a Packing Material.*—Furniture and bedstead makers, electric conduit tube makers and brass and copper tube manufacturers all use straw rope as a packing material to protect the enamelled, polished or lacquered surfaces. Straw rope is also used in the packing of fragile goods, pottery, glass ware, enamelled hollow ware and stone ware. Again, coils of barbed wire for export are frequently covered with it—not as protection to the wire, but to enable it to be handled easily and to prevent damage to other goods in contact—and chemical manufacturers use it for surrounding carboys, etc.

Straw rope is also sometimes employed in chemical and other factories as a cheap form of lagging for boilers, steam pipes, hydrants and exposed piping, when they are not exposed to undue risk of fire. This use is, however, much more common on the Continent than in England. When required for boiler lagging, the rope is made as large in diameter as possible: it is then coiled tightly round, driven close and afterwards covered with about 2 inches of clay or marl, mixed with chopped straw, grass or other dried fibre in order to prevent the caked clay when dry becoming detached in a mass. A little teased-out hemp is also a very good thing to mix in with the clay.

2. *In the Foundry Trade.*—Straw rope is also a great deal used in the foundry trade chiefly for large and heavy work, as a

corebinder and occasionally as a mould stiffener. At one time it was part of the regular work of the coremaker to twist up the straw by hand into rough ropes as required. Nowadays, it is cheaper and more satisfactory to buy it ready spun, and a good deal is imported for this purpose, which could be made quite as well and as cheaply in this country. Some large iron foundries, however, possess their own rope-making plant.

For large work, rope about 1¼-1½ in. in diameter is chiefly used. For smaller or more complicated cores, straw is not so suitable as wood wool rope which is often employed in spite of the fact that it is more expensive. Indeed, for many or all of the industrial uses outlined above, wood wool is probably a better article to use than straw, but as the rope can seldom or never be retained for use over again, the cost of the latter is frequently prohibitive.

3. *For Straw Mats.*—The machines used for spinning straw ropes can also be used for rush and reed ropes used in the making of coiled rush mats; and the installation of one or two machines might be of great advantage to an existing industry of this sort. There is no particular reason why straw should not be used in making mats of this kind to a greater extent than is done at present, and there might well be an opportunity here for the establishment of a promising village industry. Such mats should command a ready sale, as the cost ought not to be more than one-third to one-fourth of the cost of coir mats.

For mats, *rye straw* spun into ropes from ½-¾ in. in diameter is the best. Sewn together with fine twine and backed with Hessian, the mats could be made up in a flat coil either round square or oblong in shape. In order to introduce variety and to improve their market value, the straw could be dyed before being made into rope.

4. *On the Farm.*—On the Continent, the farm uses of straw rope are generally recognised and a special type of spinning machine for agricultural uses is on the market; the machine is usually hand operated, but can be had adapted for power drive. This machine makes straw ropes in short lengths up to 7 feet in small diameters of say ½-¾ in.; and by using this, the farmer can for many or most purposes save the expense of binding twine. For thatching and ricking, the use of straw ropes often means a saving of time and labour as well as an improvement in appearance.

The sizes and quality of straw rope required in industry vary greatly according to the purpose for which they are needed; ⅜ in.

diameter is about the smallest that can be satisfactorily produced, and 1½-1¾ in. diameter are about the largest that are normally required, although larger ropes than these are occasionally made. The larger sizes are chiefly used in the heavy iron foundry trade, which often requires a hard rope—from 1-1½ in. in diameter. Wheat straw is useful for this purpose, or barley straw when a softer rope is demanded. Makers and exporters of lead ware, such as pipes, guttering, etc., prefer a very soft rope of about the same size, and for this, barley straw only would generally be used. The sizes most generally in demand are ½ in., ¾ in., 1 in., 1⅛ in. and 1¼ in.

B. Varieties of Straw.—1. *Oat Straw*, owing to its value as a food, would not perhaps be used to any great extent, but, when available, it is suitable for making very good quality medium hard rope. It is best suited for sizes say ¾-1 in. in diameter.

2. *Barley Straw* is about the best of all for making rope for packing purposes. In diameters of ¾ in. to 1½ in. it makes a very soft rope; it is not very satisfactory for making the smallest sizes of ⅜-½ in., but ½-in. ropes can be made quite well if the straw is of good quality. As barley straw is cheap, and has not so great a value for farm purposes as other kinds, it can probably be generally employed with advantage in rope manufacture. The difficulty with this straw is that it is often too short to make a strong rope.

3. *Wheat Straw* being rather brittle, is not satisfactory except in ropes of fairly large size, *i.e.*, 1 in. to 1½ in. or over. It is best made into hard ropes such as are frequently required for foundry work, and it can also be used for lagging purposes.

4. *Rye Straw* is probably about the best straw of all to use. Most of the Continental imports are made of this, and being long and tough, it is particularly suitable for making ropes in the smaller sizes such as ⅜ in. to ⅝ in. diameter, but the larger diameters can be made from it equally well.

Little, if any, difference in price for the rope can be expected from using various kinds of straw except that a loose and comparatively weak rope from short barley straw would have a lower value.

C. Weights and Prices.—Considerable variations seem to obtain in the weights of manufactured straw ropes, as given by different authorities. These differences, however, chiefly occur in the larger sizes and are to be explained by variation in the closeness of the twist, *i.e.*, a soft loose rope is decidedly lighter than a hard closely twisted one.

The prices of imported ropes have fluctuated greatly during recent months and are at present high owing mainly to a severe Continental straw shortage. The prices given in the following tables are rates quoted for Dutch ropes in April, 1923—c.i.f. Hull, Grimsby, Goole, Leith, etc., and are for rye straw per 1,000 yards.

These ropes are consigned in 500-yard bales in the $\frac{3}{8}$ in., $\frac{1}{2}$ in., $\frac{5}{8}$ in. and $\frac{3}{4}$ in. sizes and in 250-yard bales in the larger diameters.

The two tables are calculated on the highest and lowest range of weights which have been communicated to us.

Table I.

Diameter of Rope—in.	$\frac{3}{8}$ in.	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.
Weight per 1,000 yards, approx., lb.	30–32	45–50	65–70	90–100	180	250	35[illegible]
Price per 1,000 yards	8/1	8/8	9/8	11/-	16/2	20/5	22 6
Yards per ton, approx.... ..	72,000	48,000	33,000	23,600	12,500	9,000	6,200
Value per ton, approx.	£29 2	20 16	16	12 13 4	10 2	9 3 9	6 19 6

Table II.

Diameter—in.	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.
Weight per 1,000 yards, approx., lb.	16	62	99	154	200	212
Price per 1,000 yards ...	8/8	9/8	11/-	16/2	20/5	22 6
Yards per ton, approx. ...	49,000	36,000	23,000	14,500	11,200	9,250
Value per ton	£21 4	17 8	12 13	11 14	11 9	10 8

D. The Rope Spinning Machines.—To produce straw rope economically and with any hope of competing with the imported article in supplying the needs of industry, special machinery is essential. A hand-operated spinner would probably suffice for making the short lengths and comparatively small quantities required by the farmer for his own use, but power driven plant would be required for anything beyond this.

It has not been possible up to the present to obtain particulars or prices of any machines suitable for the purpose, made by English manufacturers, or even to ascertain that anything of the sort is at present on the market, but no doubt once the demand for such apparatus arose, reliable home-produced equipment would soon be forthcoming.

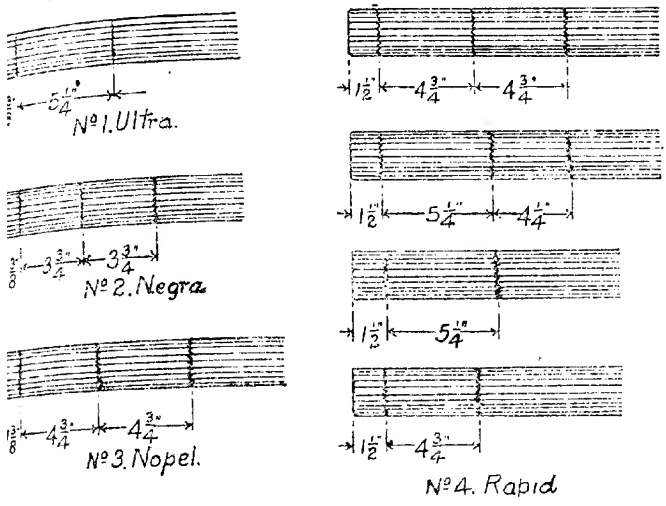

FIG. 1.—Methods of Sewing Straw Envelopes.

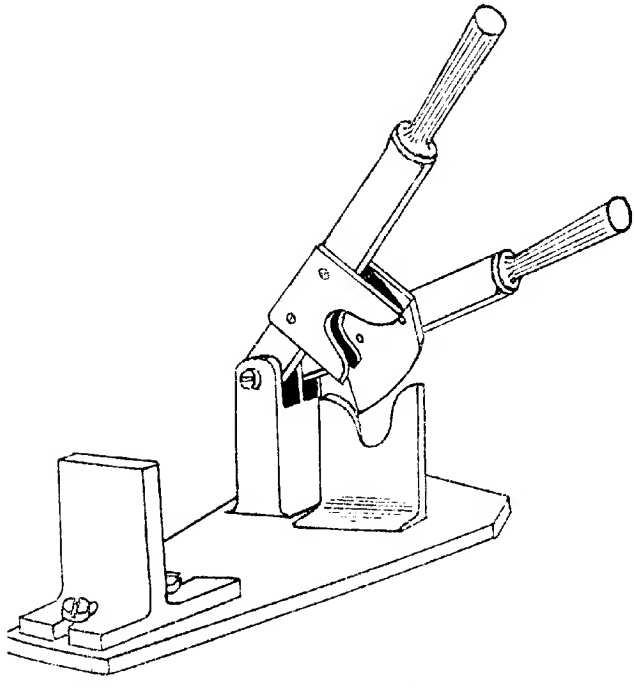

FIG. 2.—Straw Envelope Header and Trimmer—Hand-operated.

There are several patterns of Continental manufacture available. They differ little from one another except in minor details. Perhaps the simplest and most reliable of these is the "Concordia" machine, of which a general description is given below.

This type is made in 6 patterns for varying sizes of ropes:—

No.	Capacity.		Remarks.	Approx. H.P. reqrd.	Revs. per min.
	Length of Rope.	Diameter.			
		in.			
1.	7–8 feet	$\frac{1}{2}$–$\frac{3}{4}$	Hand operated	—	—
2.	7–8 feet	$\frac{1}{2}$–$\frac{3}{4}$	Power ...	0·5	50–60
3.	Up to 250 yd. ...	$\frac{3}{8}$–$\frac{5}{8}$	,, ...	0·5	40–60
4.	do. ...	$\frac{5}{8}$–1	,, ...	1·0	50–100
5.	do. ...	1–1$\frac{3}{4}$	,, ...	1·5	80–100
6.	do. ...	1$\frac{1}{2}$–2$\frac{3}{4}$	,, to special order only.	2·0	80–100

These machines produce ropes of two strands. The straw, which for good rope should be no shorter than 30 in. and preferably 3 ft. in length or over, is placed into two long narrow troughs, from which it is fed by hand as required. The ends of the straw are gripped by scored rollers, which carry it forward to the spinning boxes, where it receives a half twist—one layer over another. From here the rope passes across a pulley or through a guide to the forming box, which gives the rope its final twist and, if it is required, a sewing attachment fitted to the machine will automatically sew up the rope as it passes through this box to prevent it unravelling. A flattening device can also be put into action if necessary. This forms the rope, as it passes, into a more solid and compact state: but this is not needed in all cases. Immediately after this point the rope is caught between the two ejecting rollers, which grip it and force it through a guide, whence it passes out to the winding drums upon which it is coiled. The drum or reel can be fitted with an adjustable brake, and also with an arrangement by which the rope is wound evenly backwards and forwards upon it. A device may also be attached by which a bell is rung when the reel is getting full, in order to warn the attendant to stop and change or empty the drum.

As soon as a coil is removed from the machine, the severed end should be tied to prevent unravelling. Clipping gear, for shearing off the projecting ends of the stubble which stick out as a result of the first folding over operation, is usually fitted

to work between the first and second operations. It may be either in the form of a revolving knife or pairs of automatically operated shears.

A measuring apparatus, which will automatically stop the machine when a predetermined length of rope has been made, can also be fitted.

The size of the rope spun depends upon the amount of straw fed in by the operator from the troughs; and here skill and experience count in producing good firm and uniform ropes.

The output of the machines is stated to be approximately as follows, but it is doubtful whether the higher of the rates could be continuously maintained for any length of time :—

Small diameter	...	$\frac{3}{8}$– $\frac{5}{8}$ in. about	5– 8 yd. per minute.
Medium „	...	$\frac{3}{4}$–1 „ „	7–10 „ „ „
Large „	...	1 –1$\frac{3}{4}$ „ „	6– 7 „ „ „

The larger sizes will require two operators feeding in straw to give this output.

The use of the various sewing, flattening and clipping attachments does not interfere with the rate of production.

The hand-worked machine is generally similar to the power-driven one except that it has no winding-off reel. The rope is delivered on to a kind of projecting shelf and cut off when the length is reached for which the knives are set.

Present prices of machines are as follows. These are liable to fluctuation with the Continental rates of exchange.

Size	Nos. I & II	...	£43 approximately.
„	No. III	... ...	£46 „
„	No. IV	... ...	£48 „
„	No. V	... ...	£57 „
„	No. VI	... ...	On special application only.

Extras.

Stubble Clipper	...	...	£1
Warning Bell	...	...	£2
Extra Reels	...	...	£1 each
Straw Cradles	...	...	£1 10s. per pair
Automatic Measuring Gear	...		£4

A few remarks upon points to be considered by any one proposing to instal machinery of this kind will not be out of place.

Though they may seem rather complicated pieces of apparatus, they are in reality no more so than many other machines now used on the farm, and should not require a great deal of expert attention. Unless power is already installed and

used for other purposes as well it would probably not be so economic to put in one straw rope machine alone, as the overhead charges would tend to be rather high.

The amount of straw provided by, say, 300 to 350 acres of arable land should be sufficient to keep two or even three machines going and still leave enough to be reserved for ordinary farm uses. An oil engine of 3-4 H.P. would supply sufficient power. It would, however, not be advisable to put in anything much smaller for only one machine, and intermediate shafting will probably be necessary, even in this latter case, to step down the speed of the engine to that required by the rope-making machine.

The labour involved in tending the machines is not heavy, and it is quite possible to employ boys or girls. Two girls should be able to make from 2,000-2,500 yd. of ¾-in. rope in an 8-hour working day. It will be noticed that this figure is decidedly below the capacity of the machines mentioned above. Those figures given by the machine-makers, probably relate to conditions which would not obtain with the small user, who would not, as a rule, employ additional labour to remove and empty the drums and get them ready to put up again on the machine. Unless, therefore, a very large number of spare drums was available, as well as extra hands, the plant would not be running continuously, and in practice 2,300 yd. per day per machine must be considered a fair average working output.

Anyone situated near a large town may find another subsidiary use for a straw rope spinning machine. A lot of upholstery is done with Algerian and Coco fibre. When this fibre is wanted to be used over again, it has to be treated in order to restore its springiness or "curl," and it is therefore roped or twisted by the upholsterer before being carded. This roping is usually performed slowly and uneconomically by hand, but could be cheaply and quickly done by the straw rope spinner.

In conclusion, it may be said that straw rope is an article of extensive and extending use in many different forms of industry. At present the demand is met very largely by imports, but as conditions of trade improve, it should be possible to establish its manufacture in this country on a sound remunerative basis. The demand is a large and steady one, and a great advantage from the point of view of both maker and dealer lies in the fact that straw rope can seldom be used twice.

II. STRAW ENVELOPES FOR BOTTLES.—The trade in these articles has fallen off somewhat in late years, but is still considerable. The following figures for quantity and value of imports are given by the Board of Trade:—

Imports			*Value*		
1913	1920	1921	1913	1920	1921
Gross	Gross	Gross	£	£	£
1,047,302 ...	667,085 ...	471,635 ...	96,888 ...	159,630 ...	103,593

The majority of straw envelopes now come from Holland and France and are very largely used in the export trade. For internal transport they have been for some years rather superseded by sectional returnable packing cases, with corrugated straw board as an extra protection to bottles with specially valuable contents. The main advantage of these cases is that less space is occupied, but they are rather more expensive and less efficient in preventing breakage than straw envelopes, hence the use of the latter in the export trade as a rule. The straw envelope has lately been regaining its old position in home transport as well.

The principal users in this country are the cider makers in Somerset, Devon and Wilts, the whisky trade, bottling firms and exporters at various seaports, and the chemical and confectionery trades.

The machinery used for producing envelopes is easy to work and makes them very rapidly. The output of the different sizes varies from 200 up to about 500 envelopes per hour with power drive. The smaller sizes can also be worked by treadle if desired, but the output is of course less. There is no doubt, however, that these sewing machines are rather more complex and delicate pieces of mechanism than the general run of agricultural machinery and while they are in fact very easy to work and intended to be operated by unskilled labour or by girls, a skilled mechanic would be required to look after them at intervals. For this reason they are probably more suited for a factory than a farm.

Process.—The following is a general description of the method of making straw envelopes; details and the sequence of operations may vary somewhat with different types of machinery. The straw, when it has been "hackled" or combed out to lie evenly, is placed in a trough alongside the sewing machine. At this stage, if it is much longer than is required, it is cut to a length about 1 or 2 inches more than twice the length the finished envelope will be, by means of a

guillotine knife at one end of the trough, the proper length being obtained by a wooden stop plate which can be fixed at any required distance from the knife. Under factory conditions or for large output, the "hackling" and cutting to length would be distinct operations; the material would then be brought to the seaming machine operation ready for use. The straws composing the envelopes are doubled over upon themselves before being sewn together (*i.e.*, for a quart bottle envelope which is about 15 in. long when finished, the straw would have to be 30 in. long plus an allowance of ½ in. to 1 in. for trimming after "heading" and "tying").

There is no particular objection to the ears being left on, provided that the tied end of the envelope is long enough for them to be clear of any row of stitching. In practice the ears are often found left in, but in the best quality envelopes made of rye straw which grows long, they are generally absent. Great accuracy in length in this first stage is not necessary, provided always that the straw is more than double the length of the finished article. All the sewing takes place at a fixed distance from the fold of the straw, which forms the open bottom end of the envelope.

It is essential that the straw should be thoroughly dry: damp straw will rot the thread, and is liable to split, and will produce damaged envelopes, when they are pressed into bales for transport.

The operator now takes a handful of straw and lays it in position on the operating table of the sewing machine: it is here that skill and experience are chiefly required to put on just the right amount required to make a good envelope, which should be firm, of the proper weight, and even in texture all round with no open or thin and loose patches. The necessary skill is soon acquired by practice, and the speed at which a good worker can feed the machine is very high. The working table of the machines is known as "the book"; it is hinged at the centre and the straw is placed upon it when lying open, and spread evenly out; the "book" is then shut with a metal finger piece, something like a book marker slipped in at the centre. The straw is thus doubled over evenly on itself. The thin finger piece can then be pulled out, and the folded straws are sewn together.

At one time the envelopes were sewn merely as a flat straw sheet which was then bent round to a circular shape and tied by hand, but practically all modern machines, such as those

referred to in this article, produce the envelopes in the finished circular form required. The envelopes are given 2 or 3 rows of stitching according to the size or the machine used; it is usually the ordinary chain stitch which can be easily cut without unravelling. It is only a very large envelope that requires 3 rows.

Straw Envelope Sewing Machines.—The machines, of which particulars and prices are given below, are of German or Dutch manufacture, and so far as it has been possible to ascertain there is no English make obtainable.

Trade Mark.	*H.P.*	*Type.*	*Capacity.*	*Approx. Price.*	*Power.*
			per hr.		
1. "X-Plus Ultra"	¼	2 stitch ..	200–250	£50 £55	Power Foot treadle
2. "Nora" ...	¾	3 stitch ..	200–280	£53 £59	Power Treadle
3. "Nopel" ...	¾	3 stitch...	250–300	£58 £64	Power Treadle
4. "Rapid" ...	1·0	2 or 3 stitch.	400–500	--	Power only

No. 4 is a large machine and fully automatic. In this type, the position of the circumferential stitching is capable of adjustment or alteration to suit different bottle shapes. The envelopes produced range from 2 in. to about 4¾ in. diameter (Fig. 1).

After seaming, the envelopes are "headed" by an appliance operated by hand or treadle. The operation consists of squeezing tight the loose (*i.e.*, unsewn) end of the envelope, binding it and clipping off any surplus straw. Squeezing and trimming and binding are performed in the one appliance. Fig. 2 shows a hand-operated "header"; the pallet is adjustable to accommodate different lengths of envelopes, which are held in the crutch of the machine, while being bound. The treadle-operated grip is, however, the more convenient as both hands are then left free for binding.

The hand-operated machine costs about £8 10s. 0d. and the treadle machine £11, but there is nothing very special about them and they could probably be made locally for less

The finished envelopes are very light and bulky, and require baling for transport purposes, and a hand or power-press would be required for doing this—the hand-press costing from £25 to £40 according to capacity, the power-operated press rather more.

Envelopes are generally imported in bales of 2 gross. The size of a compressed bale of quart bottle envelopes is approximately 30 x 24 x 15 in. and the weight of such a bale should be 44 lb. The weights of envelopes vary of course very much according to size and are from about 8 lb. per gross in the very small special sizes to 35 lb. or more in the large envelopes required by the confectionery trade, say, for large sweet bottles.

The quart bottle size in most common demand runs about 22 lb. per gross.

Prices of Imported Envelopes.—Quart size is the standard article and special sizes either above or below this are generally rather higher in price; the very small sizes are considerably more expensive. Present prices (April, 1923) for quart size are as follows:—

	s. d.	s. d.	
Dutch manufacture	3 0	to 3 8	per gross.
French „	3 8	to 4 0	„ „

These prices are higher than they have been at any time previously, owing to the existing straw shortage in Holland, Belgium and France. But for this shortage, the price would be about 2s. 6d. to 3s. per gross only. Pre-war prices were from 1s. 10½d. to 2s. It is of interest to mention that the managing director of one of the largest London importing firms has recently stated that he would be very glad to deal with home-manufactured straw envelopes, if they could be obtained in good quality and quantity, and at a reasonable price.

The machines described in these notes may be obtained through Messrs. Country Industries, Ltd., to whom any inquiries as to prices and delivery should be addressed, while the Secretary of the Rural Industries Intelligence Bureau will be pleased to give any additional information which may be in his possession.

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TRAINING IN COMMERCIAL POULTRY KEEPING.

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THERE are several reasons why it seems desirable to publish an account of the poultry department which is now very nearly completed at the Hertfordshire Institute of Agriculture, at Oaklands, near St. Albans. These may be summarised as follows:—

(a) The whole department has been laid out on a definite plan with the result that both unity and completeness have been secured.

In considering the details a small committee of poultry experts, under the chairmanship of Mr. T. W. Toovey, has rigorously excluded any unnecessary elaboration, and adhered to the principles of economy and utility. The plant is, therefore, perhaps the simplest and most economical that is likely to be commercially successful.

Clearly the cheapest method of keeping poultry on farms would be the organized extension of the free run system, but the possibility of depredations by foxes should be borne in mind when choosing the site.

(b) The houses which have been erected are of a type which has been proved to give good results, and the design is so simple that they are both cheap and easily constructed.

(c) The main system of rearing is one that involves the fewest complications, while at the same time provision has been made for systematic natural hatching on a small scale.

(d) The completed department consists of an 800-bird plant with all the necessary rearing facilities to maintain it, and at the same time to supply sittings of eggs, etc. This size has been determined upon as it provides a complete one-man commercial proposition.

(e) The objects of providing this department are defined in the prospectus of the Institute as follows:—

(1) To demonstrate a system or systems of poultry keeping which actual accounts will show to be profitable, and which could be copied in the county with similar results.

(2) To provide the means of training young men and women in all details and processes in successful and profitable poultry keeping.

The information given should also appeal to the general farmer whether he thinks of keeping 100 or 1,000 birds. In these days farmers cannot afford to neglect any side line which might prove a source of profit. Poultry keeping on farms is too often neglected. This is most unfortunate as the farmer has often at hand the very conditions which would ensure a profit from well-managed poultry.

The Department was started in the spring of 1922. A month or two previously a score of pure-bred White Leghorn pullets and a "Daily Mail" laying house had been purchased at a sale, but apart from these two items the whole plant has been built up from nothing. Immediately after the poultryman had taken up his duties in March, 1922, steps were taken to commence hatching and to provide the necessary rearing houses. Eggs were purchased of reliable strains of Rhode Island Reds and White Wyandottes, and resulted in 300 pullets being reared. These came into profit from October onwards.

During the winter of 1922-3 further houses were completed in anticipation of hatching in the spring of 1923 enough birds to complete the stocking of the plant. To get the necessary eggs for hatching, a number of 2nd year breeding hens were purchased and mated with home-bred cockerels. These, along with the Leghorn pen and some cross-breeding pens, provided the required eggs for incubation or natural hatching. By the autumn of 1923 the plant will be complete.

Incubation.—An excellent incubator room was provided at very little expense in a disused stable, a portion of which was boarded off and the floor concreted. Electric light was introduced for convenience at night, and for testing eggs for fertility. On many farms there exist buildings which could be similarly cheaply converted. The rest of this building with part of the granary overhead is utilised as a food store.

Four incubators—two 100-size Hearsons, one 150-size Glevum, and one 150-size Gloucester were obtained.

Natural Hatching.—A natural hatching house has been provided to accommodate 16 sitting hens. The system is a copy of that so successfully practised by Mr. T. W. Toovey, of King's Langley. The total length of both the nest and the airing chamber is 3 ft. 3 in., 15 in. being taken by the nest

FIG. 1.—Nests for Natural Hatching.

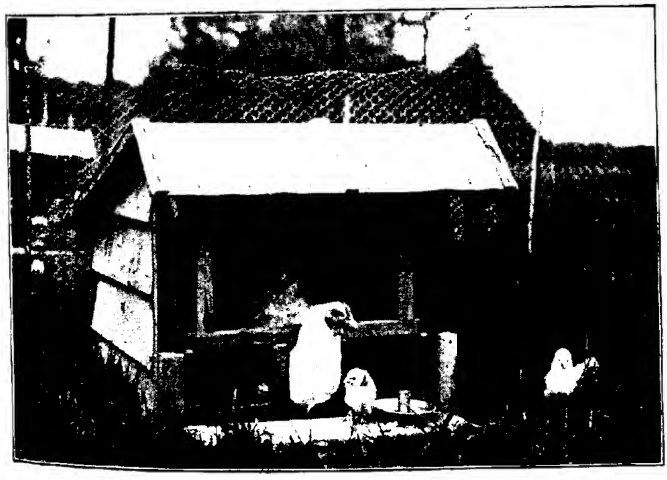

FIG. 2.—Coops used in Natural Hatching.

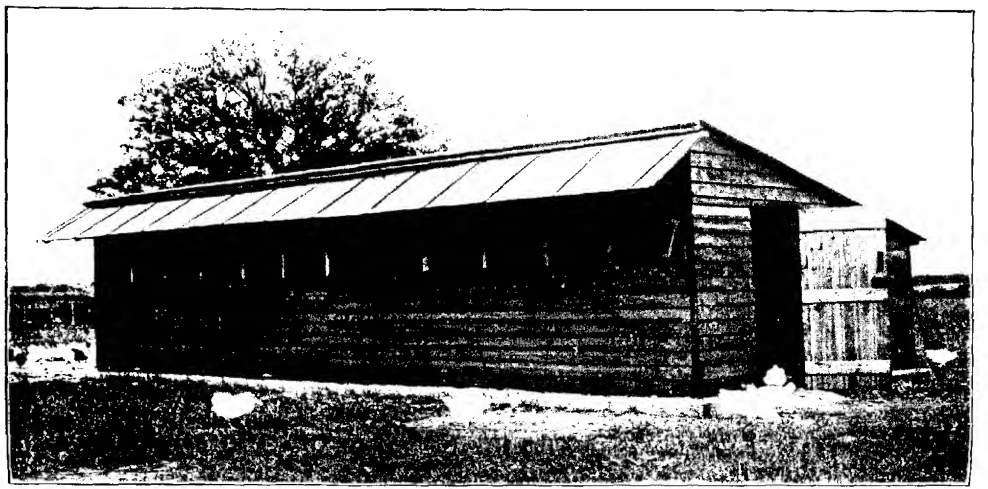

FIG. 3. -Laying House.

and 2 ft. for the airing and feeding chamber. The depth is 17 in., and height 16 in. There are two doors in front and a small door between the nest and the airing chamber.

These nests can be arranged in any suitable building in tiers 3 or 4 deep. Quite a number of hens can, therefore, be set at one time, and require the minimum of supervision. On hatching, the hens with their broods are transferred to special coops which are set out in a series of small grass enclosures 10 ft. square. The use of these nests and coops (Figs. 1 and 2) enables natural hatching to be carried out on a small or a large scale, in a simple yet systematic manner.

Rearing.—Incubator chicks at 24 hours old are transferred to hovers which are placed in cabins 6 ft. square x 6 ft. high built for the purpose. There are now eight of these cabins, and these along with the "Daily Mail" house provide accommodation for 10 hovers. The hovers are designed for 100 chicks, but it is better not to exceed 70-80 in each. Each cabin is well ventilated and is situated on 500 square yards of grass run. The particular type of hover used is that made by Halsall. They are very simple in construction, and have given good results.

Chicks either from hens or from the hovers are transferred at 6 weeks old to the rearing houses, which are built to the same specification as the laying houses described below. Till the young birds learn to perch they are divided up into small units of about 30 by means of temporary and movable partitions of wire netting.

The following is a specification of one of the cabin houses:—

		£	s.	d.
240 ft. ...	6 in. F.E. boards at 14/- per square	0	16	10
100 „ ...	5 in. × ¾ in. match boarding at 23/6 per square	0	10	0
84 „ ...	6 in. × ¾ in. rough boards at 20/- per square	0	8	5
182 „ ...	2 in. × 2 in. „ „ at 1⅛d. per foot ...	0	17	0
60 „ ...	2 in. × 1 in. „ „ at ¾d. „ „ ...	0	3	9
72 „ ...	6 in. × 1 in. „ „ at 1½d. „ „ ...	0	9	0
1 in. wire netting, 3 ft. × 3 ft.				
5 yd. felt...				
1 pane glass, 36 in. × 13 in.		0	12	0
Tar, garnets, etc.				
Labour		1	3	0
		£5	0	0

Laying Houses.—The essential features of these houses are as follows:—They are 30 ft. long x 14 ft. wide, 8 ft. high in

front and 5 ft. at back. No glass or dropping boards are used, and the top half of the front is open but protected by an overhanging hood (*see* Fig. 3). The floor is concreted and the sides and half the front are built of feather-edge boards. For the back, plain ½-in. boards are used, and these are covered on the outside by felt to prevent all possibility of draughts on the perched birds. The roof is boarded and covered with felt, though the cost may be lowered by dispensing with the boarding, using felt only. On completion the whole exterior was well treated with a mixture of tar, pitch and lime.

Dropping boards are dispensed with as these entail much labour, and their absence enables the perches to be placed only 18 in. from the floor, and therefore well away from any draught from the eaves. The perches are 3 ft. long and are placed at right angles to the back, over a manure pit. Each house provides accommodation for 100 laying birds, and each of these units is allowed half an acre grass run.

The specification for these houses is as follows:—

	3 in. × 3 in.		3 in. × 2 in.		5 in. × 2 in.	
	No.	Total length.	No.	Total length.		
Front uprights...	4 of 9 ft.	36 ft.	9 of 9 ft.	81 ft.		
Back „ ...	4 „ 6 ft.	24 ft.	9 „ 6 ft.	54 ft.		
Sides and middle uprights ...			10 „ 9 ft.	90 ft.		
Top rafters ...			11 „ 15 ft. 6 in.	170 ft. 6 in.	2 of 16 ft.	32 ft.
					1 „ 8 ft.	8 ft.
Plates... ...			6 „ 10 ft. 6 in.	63 ft.		
Over door, etc....			1 „ 12 ft.	12 ft.		
		60 ft.		470 ft. 6 in.		40 ft.

				£	s	d.
Summary (3 in. by 3 in. / 3 in. by 2 in. / 5 in. by 2 in.)	Uprights and Rafters	60 ft.	at 2½d. per foot	0	12	6
		470 ft. 6 in.	at 1⅝d. „ „	2	13	10
		40 ft.	at 2⅝d. „ „	0	7	11
2 Doors	90 ft.	1 in. matching	at 26s. 6d. per sq.	0	11	11
Brackets...	78 ft.	2 in. by 2 in.	at 1½d. per foot	0	7	4
Door stops	75 ft.	2 in. by 1 in.	at 1d. „ „	0	6	3
½-in. boards	6½ sq.	5 in. by ½ in.	at 15s. per sq.	4	17	6
F.E.B.	4½ sq.	6 in. by ¾ in. by ¼ in.	at 14s. „ „	3	3	0
2 bundles laths ...	1 in. by ¼ in.		at 3s. 6d. each	0	7	0
Perches:						
1 piece	6 ft.	4 in. by 2 in.	at 2d. per foot	0	1	0
4 pieces	15 ft.	3 in. by 1½ in.	at 1¾d. per foot	0	8	9
24 pieces	3 ft.	2 in. by 1¼ in.	at 1d. „ „	0	6	0
3½ rolls felt	84 yd.	24 yd. rolls	at £1 per roll	3	10	0

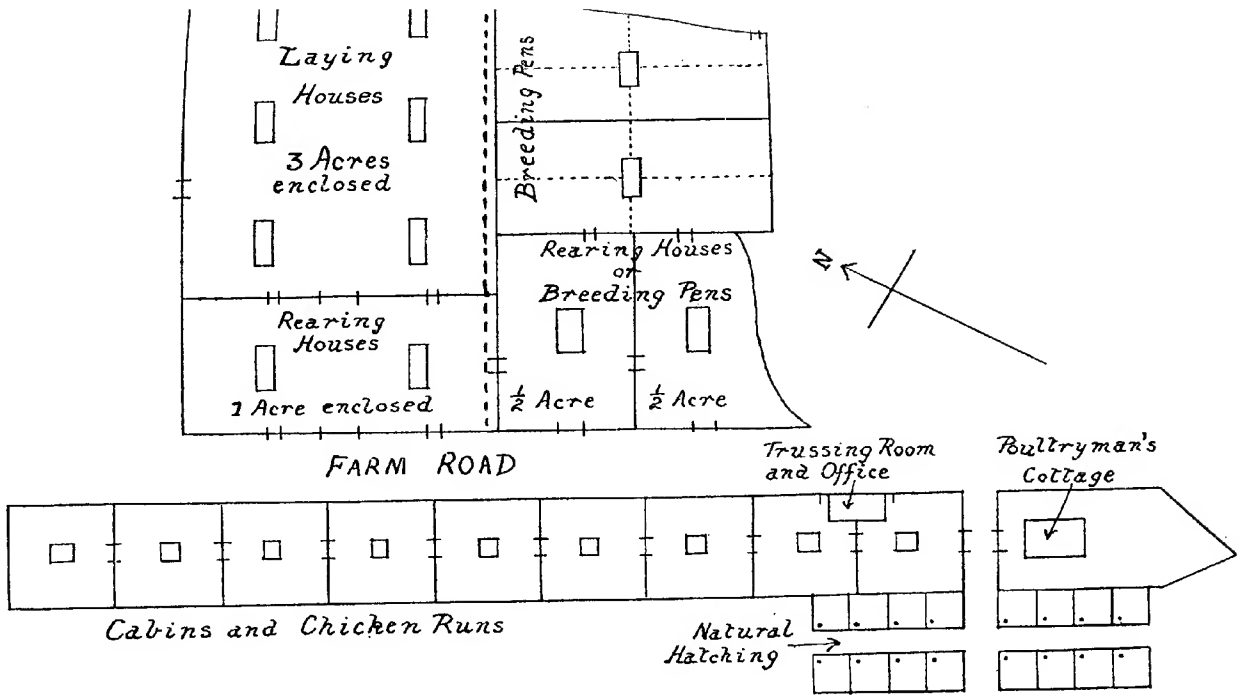

FIG. 4.—Plan showing Lay-out of Poultry Department, Herts Institute of Agriculture.

			£	s.	d.
5 bags cement		at 4s. per cwt.	2	0	0
10 ft. wire netting 1 in. mesh			0	12	6
6 gallons tar and pitch, locks, garnets, latches			1	2	0
Front to manure pit 60 ft.	8 in. by 1¼ in.	at 2½d. per foot	0	12	6
			£22	0	0
Labour: Two men for a fortnight			10	0	0
			£32	0	0

In this specification no charge has been made for gravel, which may be obtained locally. By using 2 in. x 2 in. for uprights instead of 3 in. x 2 in. and dispensing with boards under the roof felt the cost could be reduced to £27.

The Complete Plant.—The complete plant consists of twelve houses of the type just described under laying houses. Six of these serve as the laying houses proper and are enclosed in one open run which allows half an acre to each house. Two or three houses are used for breeding pens. Each of these is divided into two with a breeding pen in each, and each pen has a double grass run. The other three or four houses are used for rearing. In addition a small three-compartment hut has been erected to provide the poultryman with an office, a trussing room, and a chick food store. A plan showing the lay-out of all the houses is shown in Fig. 4.

It is not intended to keep more pure breeds than the three already mentioned, viz.—Rhode Island Reds, White Wyandottes, and White Leghorns. A number of first crosses will, however, be reared, as apparently, as so often happens with farm animals, the first cross in poultry, if effected in a desirable manner, provides stronger and more profitable birds.

Everything possible has been done to economise in labour. The removal of manure will be done at regular intervals by a horse and cart. Water has been laid on through the department as is shown by the dotted line in the plan.

A plant of this description is perhaps unique. There is nothing superfluous, and it is confidently anticipated that at a later date it will be possible to publish a balance sheet which will prove the soundness of its conception.

The actual cost of building up the poultry plant might be given, but the figures would not apply generally, as in this instance a good deal of home-grown timber was used. The

following figures, however, given an approximate estimate when all the materials are purchased :—

	£	s.	d.
12 houses ... ... at £32	384	0	0
10 cabins ... ... at £5	50	0	0
Wire netting	80	0	0
Office, trussing room, chick food and egg store ...	25	0	0
Incubator room (old building utilised) ...	10	0	0
Four incubators	46	0	0
Coops, etc.	18	0	0
Laying on water	12	0	0
Incubator eggs and breeding birds	120	0	0
Sundries	25	0	0
Labour	180	0	0
	£950	0	0

On this basis the cost of setting up an 800-bird poultry plant approximates to 24s per bird when live stock are included, and 20s. per bird exclusive of live stock.

* * * * * *

THE PRINCIPLES OF POULTRY FEEDING.

I.

POULTRY can produce concentrated, palatable and easily digested human food, in the form of eggs and meat, from materials that are frequently unsuitable for other domestic animals and might otherwise be wasted. Waste and surplus vegetable material from the garden and allotment, household scraps, the residue of grain left from the harvest fields and stack-yards, are instances of food materials which the hen is capable of converting into eggs and meat. When given free range, particularly over arable land during cultivation, poultry consume large quantities of grubs and worms, insects and green food, and are known to be valuable agents for the destruction of ground pests. Hence, under suitable conditions and at certain seasons not only will poultry find much of their own food, but will help to keep down destructive insects.

The object of the poultry-keeper is to convert various feeding materials into eggs and meat in the most profitable manner, and therefore some knowledge of the several aspects of the science and practice of feeding is desirable. The functions of food are:—

(1) To maintain the body of the fowl in normal healthy condition.

(2) To provide for production, *i.e.*, growth, flesh and eggs.

In order to maintain the body of a healthy adult fowl in normal condition, *i.e.*, without gain or loss of weight, food is required to keep up the heat of the body, to provide energy for digestion and the movements of the various active organs of the body such as the heart, lungs, intestines, etc., and to repair the waste of body tissue which is constantly going on even in the body of a resting and unproductive animal. If only sufficient food for maintenance is given to the fowl, few eggs and no additional flesh can be produced. For production, additional food must be supplied, and if rapid and constant production is required, the supply of food must be not only liberal but of a suitable character and be supplied under suitable conditions.

The value to the poultry-keeper of any feeding stuff depends mainly on the following factors:—

(1) Composition.
(2) Digestibility.
(3) Mechanical condition.
(4) Value in comparison with other feeding stuffs.
(5) Class of stock to be fed and the object in view.

Composition of Feeding Stuffs.—Every feeding stuff consists of various chemical constituents, but as several of these constituents possess similar nutritive values, they are for practical purposes classified into groups. The principal of these groups are:—

(1) Proteids.*
(2) Carbo-hydrates, *i.e.*, starch, sugar, fibre, &c.
(3) Oils and fats.
(4) Mineral matter.
(5) Water.

Proteids.—The proteids are a vitally important food constituent. They are essential for the maintenance of the fowl and for all forms of production. Whilst under certain conditions proteids can fulfil the functions of the carbo-hydrates and fats, the two latter can never fulfil the functions of proteids. The nutrition of the animal, however, is achieved much more efficiently and economically when all three constituents are supplied in proper proportion. Proteids should never be supplied in excess. Not only are foods rich in proteid the most expensive to purchase, but if unnecessary quantities of proteid are fed to poultry, considerable and unnecessary strain is thrown upon the kidneys and liver in excreting the surplus.

* A group of food constituents known as the amides is for the purpose of this article included in the proteid group, to which they are closely allied. They are chiefly found in rank young grass and roots and their functions are not at present thoroughly understood.

Carbo-hydrates, Oils and Fats.—These supply the fowl with heat and energy and any surplus consumed beyond what is necessary for this purpose is stored up in the body as fat. Fibre, which is one of the carbo-hydrates, constitutes the outer coat of seeds and is found in the stems and leaves of plants. As the plant ripens this fibre often becomes of a tough woody character and so far as our present knowledge goes, fowls can digest this fibre only to a very small extent; in fact, apart from the necessity of supplying a certain amount of bulk in a poultry ration, it is advisable to eliminate fibre from the poultry ration as far as possible. Oils and fats have a similar function to carbo-hydrates in the body of the fowl and supply heat and energy, but are nearly two and a-half times as efficient in this respect as carbo-hydrates. An excess of fats in the foods should be avoided, however, as otherwise the digestion of the fowl will be affected. On the other hand, the yolk of the egg contains over 33 per cent. of material of a fatty nature and consequently the laying hen must have sufficient fat producing material in her rations.

Mineral Matter.—Poultry, especially laying hens, undoubtedly require considerable quantities of mineral salts, particularly those of calcium, such as carbonate of lime. It is probable that growing birds and laying hens are in practice inadequately supplied at times with mineral salts. Growing birds require regular supplies to enable them to grow and to build up their frames. Laying hens, especially those of heavy laying strains, use up considerable quantities of mineral salts in producing their eggs and unless they obtain sufficient supplies in their food, the body tissues are drawn upon and the healthy equilibrium of the body is disturbed. It is probable that fowls can absorb mineral salts in an inorganic form, such as for instance, calcium phosphate, magnesium sulphate, etc., but the poultry-keeper will be well advised to include in the poultry rations those feeding stuffs, such as freshly-cut green bone, fish meal, meat meal, skimmed milk, etc., and fresh green stuffs, which are rich in mineral salts. The use of such feeding stuffs in proper proportions will not only ensure a sufficient supply of mineral salts, but also of the much discussed accessory food factors, the vitamins. Cod liver oil is rich in the vitamin known as Fat Soluble A, and is often used in the poultry ration for this reason at the rate of a teaspoonful to every pound of the food. It is particularly useful for growing chicks and for hens producing eggs for hatching purposes.

Water.—All foods, even the driest feeding stuff, contain more or less water, while turnips may contain as much as 92 per cent. From the chemical point of view this water has no more food value than ordinary water which is taken in the usual way. A succulent food such as fresh clover, however, is probably of more value to the hen than dried clover meal.

Use of Tables.—The table to follow at the end of this article shows the chemical composition of most of the feeding stuffs used by poultry-keepers. This table will enable the poultry-keeper to determine whether a feeding stuff is rich or deficient in one or more of the essential food constituents. For example, maize is seen to be fairly rich in fat and carbo-hydrates, but somewhat deficient in proteid; oats are a better balanced feeding stuff than maize, whilst meat meal, fish meal, dried yeast and maize gluten meal are seen to contain high percentages of protcid. Dried yeast is also rich in mineral salts. An unusually high percentage of ash or mineral salts shown on analysis of a *manufactured* feeding stuff, however, often indicates the presence of dirt or sand.

Digestibility of Food Stuffs.—There is little use in giving feeding stuffs which the birds cannot easily digest. Such efforts are demanded from the digestive organs of the modern layer, which is expected to produce upwards of 200 eggs in the year, that if the food given to her places too great a tax on her digestive energies, or if the nutriment contained in the food is insufficient, a high egg yield is impossible. The foods used should be palatable and easily digested in addition to being nutritious. Unfortunately very little reliable knowledge based on scientific investigation is yet available regarding the digestive powers of poultry. Such knowledge as is available, however, indicates that the capacity of poultry for digesting the various feeding stuffs in common use approximates more closely to that of the pig than of other farm animals. Apparently poultry can obtain little nutriment from crude fibre such as the husk of oats, or the fibrous portions of cut clover prepared from plants past the flowering stage. Maize and maize meal appear to be more digestible than either wheat or oats, and there is considerable evidence to indicate that maize is a most valuable grain for poultry when combined with foods rich in proteids and some bulky material such as cut clover of good quality. The fat in oats is apparently easily digested by fowls, and this is confirmed by the old-established practice of using Sussex

ground oats for fattening purposes. In spite of the indigestible character of oat husk, Sussex ground oats are found in practice to be one of the most valuable foods for general use. The scanty scientific information available on this subject emphasises the need for further reliable scientific investigation into the digestive capabilities of poultry. The commercial importance of the science of poultry-feeding is obvious. It is just as important as a knowledge of the heat-producing values of various fuels is to the engineer and to the owners of steam engines. In the meantime, the poultry-keeper should be guided in his feeding methods by the best modern practice, bearing in mind any advantages offered by locally produced feeding stuffs, seasonal supplies and variations in market prices, and should keep an alert eye open for any new information which may result from further scientific investigation.

The table given in Part II shows not only the chemical constituents of the various feeding stuffs, but also the percentage of digestible nutrients. The latter percentages are based on direct experiments with quadrupeds, including pigs, and although further scientific investigation may show that these percentages are not quite accurate for poultry, they probably constitute in the meantime the best guide available. Thus it is seen in the case of oats that whilst this grain contains 10.3 per cent. of proteid, 8 per cent. only is digestible, but nearly the whole of the fat is digestible and 44.8 per cent. out of 58.2 per cent. of soluble carbo-hydrates. In considering the composition of a feeding stuff, the digestible nutrients are a better guide to the feeding value than the mere chemical analysis, though attention should be paid to the amount of fibre and ash present.

The Class of Stock to be Fed and the Object in View.—The natural common sense of the average poultry-keeper will no doubt indicate to him that young chickens require feeding stuffs and methods of feeding different from those suitable for adult laying stock or fattening stock. For example, ducklings intended for consumption when about 10 weeks old may be supplied with some forcing and fattening foods from birth; on the other hand, young pullets required later on to endure the strain of heavy egg production must be fed with the object of building up frame and constitution. Breeding stock too must not be fattened, but maintained in hard, healthy and fairly productive condition. Laying stock during the autumn and winter months will require careful and liberal feeding on

egg-producing foods. These various objectives will necessitate different rations and methods of feeding if commercial success is to be fully achieved.

Mechanical Condition of Feeding Stuffs.—The fineness or coarseness of meals, the amount of extraneous matter such as dirt, stones, weed seeds, etc., in samples of grain, the presence of "smutted" grains, obvious adulteration with husks or other worthless material, the colour, smell and taste of a sample may all be regarded as part of the mechanical condition of a feeding stuff and should be carefully observed by the purchaser. Sour or mouldy meals and samples of light husky grain should invariably be rejected.

(To be concluded.)

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GROWING TURNIP, SWEDE AND MANGOLD SEED IN THE HOLLAND DIVISION OF LINCOLNSHIRE AND ADJOINING DISTRICTS.

THOMAS W. LANE.

CONSIDERABLE acreages of root seeds are grown in Lincolnshire, more especially turnip and swede, in a less degree mangold seed; cabbage and kale seed to a limited extent, and occasionally rape seed. In addition a large acreage of brown and white mustard is grown chiefly for manufacturing purposes, but some white mustard is also grown for seed purposes. The fact that south Lincolnshire is specially adapted for seed growing may be due to several causes, chief of which are the natural richness and deepness of the alluvial soil, proximity to the sea, and the large acreage of rich pasture land broken up during the past few years. As this land cannot be used for corn for several years the choice of crops is almost limited to brown mustard, turnip and swede seed and potatoes. Some farmers object to brown mustard from the fact that it is often extremely difficult to get rid of, and appears as a weed for many years. Turnip and swede seed are not open to the same objection to the same extent.

The writer has no exact information as to the acreage under root seeds. It fluctuates considerably; for instance, in the event of a somewhat general failure, as in 1922, the next season's acreage is above the average, but in normal times it runs to several thousand acres. A large proportion of the produce is

exported. The actual volume of the world's trade in seeds has probably grown during the past few years but competition from Continental growers has increased perhaps in greater ratio, therefore an expansion of the industry is not likely.

It is difficult to estimate cost of production or probable returns. The best and cleanest land is usually chosen, the cost of cutting and thrashing is higher than with corn crops, and planting adds considerably to the expense. The crop is a speculative one, but in a series of years the average returns are perhaps substantially higher than with corn crops.

Probably in relation to other crops there is a higher proportion of swede and turnip seed grown in the Holland division of Lincolnshire than in any other district in the country, and perhaps the largest acreage. The root seed growing area extends beyond the borders on a diminishing scale, but in the outskirts of the seed growing area and on isolated crops it has sometimes been found that larks and wood pigeons destroy or damage crops in the early stages, and linnets take a considerable toll of any surviving crop when in seed. One of the reasons why farmers in this district like to grow some turnip seed is that it provides a change of rotation and is harvested early, between getting the clover hay crop and mustard cutting and corn harvest. The stubble can be ploughed up early and is available for wheat if required. One of the drawbacks of the crop is that in the event of its being a thin or poor plant weeds are very troublesome, the land is left rather foul, and the straw is of little value.

The bulk of the crops is grown for the trade on contract from seed stock provided by the merchant. Stock seed being the produce of selected roots and the seed trade being highly specialised it will be understood that merchants select specially for the requirements of their own particular trade. The industry has created a large body of expert planters and cutters, who are usually paid by piece work—planting by the thousand or by the acre, and cutting by the acre—and earn good wages.

The soil of the district varies from light silt almost to clay, with a small area of black land and skirt land (silt and black mixed). The most generally reliable land for turnip seed is medium or good bodied silt land.

Turnip and swede seed can only be grown successfully even in this district on the best and cleanest land. It must be in good heart and these crops grown only at long intervals. There is nearly always a considerable percentage of crop failures, in some seasons a small percentage only surviving. A thoroughly

prepared seed bed is the first essential for success; errors of cultivation account for some failures—amongst other causes are insufficient preparation of land, especially insufficient rolling, drilling seed too deeply, drilling artificial manure with seed, and drilling too late—but even under apparently perfect management failures occur.

Turnip Seed.—It was at one time thought that turnip seed could only be grown satisfactorily on fallows, but it is now taken after almost any crop excepting perhaps white corn. Well mucked fallows, however, remain the best preparation.

The seed is drilled on the flat at the rate of 2 to 3 lb. per acre, usually with four coulters in a drill, and as farmers' drills vary in width the rows vary from about 18 to 23 inches apart. It is usually drilled on rolled work but sometimes after a light harrowing. The seeding period extends from the second week in August to the first week in October, according to the class of land and individual farmers' ideas. The tendency of recent years has been towards late drilling as it has been found that the late drilled crops yield better—perhaps partly because if bolbs are developed they are more tender than plants, and partly because a crop of roots makes more demand on land than small plants and leaves the land lacking in sufficient stamina to finish the seed crop. It may be suggested that on medium soils, in order as far as possible to ensure plants getting strong enough before the winter, yellow turnip should be drilled not later than the 14th September and white turnip by the 21st, but farmers do not usually differentiate sufficiently between the varieties. On freshly broken land later sowing may be desirable and on strong or stiff and black land earlier sowing is indicated, but from the fact that we have not had much winter in recent years, farmers have acquired a habit of late sowing.

In addition to perhaps some fertiliser applied in the autumn it is not unusual to top dress in the spring with up to 2 cwt. of sulphate of ammonia or nitrate of soda.

The crop may require considerable attention in the early stages. In the first place, to keep flea and other pests from damaging or destroying it, as soon as the plant appears it is probably rolled, perhaps horse hoed once or twice, and harrowed between rows in the autumn. It is again hoed and perhaps harrowed in the early spring to destroy small weeds and to free the plants from chickweed. Provided, however, that the crop is free from weeds, very late autumn or very early spring cultivation is not desirable as the crop resents disturbance during

frost. As the season advances it is also cultivated more deeply between the rows from time to time as long as horses can be kept in the crop, and in some cases as a final operation the rows are hilled or moulded up with the object of burying the remaining weeds, chickweed especially, and with a view to holding the plants up and preventing storm damage. This, however, is not a general practice.

In case of gaps in the crops, planting is resorted to for filling in, plants being taken from thicker parts. A very thick plant is sometimes horse-hoed across, but unless it is thick all over the land, hand-hoeing is better. Some farmers do not thin out at all. It cannot be stated definitely that thinning out is best in all circumstances and conditions, but it may be assumed to be advantageous generally, resulting as a rule in stronger plants. The ideal plant perhaps is one that has come regularly and thinly throughout, as these plants are not drawn up, and develop into broad-leaved strong plants, giving a satisfactory yield.

Swede Seed.—One advantage of swede seed growing over turnip is that, as it is not planted till November, there is plenty of suitable land available (it is generally taken after potatoes), only a small space being wanted for the plant bed in proportion to the acreage to be planted. The price paid is also higher in consideration of the cost of extra labour involved in planting. Swede seed is a more speculative crop than turnip—the rewards may be greater but so are the risks. Planting subjects it to a severe check and unless conditions are favourable often a considerable number of plants die off. Being slower in growth in all stages it appears more liable to attack by pests.

The usual method in Lincolnshire for swede in contradistinction to turnip seed is to sow the seed on a plant bed any time from about 20th July to 14th August, the general experience being that it should at any rate be sown by the first week in August. It is sometimes broadcast, but usually drilled with a hand drill about 12 inches from row to row, or with a corn drill, the advantage of drilling being convenience in hoeing. Stocky plants are desirable, and if land can be spared it is well to allow one acre plant bed for about 7 acres crop, less of course being wanted for broadcast sowing. At this time of year it is very difficult to obtain a plant if the weather is exceptionally dry, and there may be considerable difficulty in warding off the turnip flea: the mustard bug also is frequently active and troublesome.

The usual allowance of stock seed is 2 lb. per acre, which in favourable circumstances would provide plants far in excess of requirements, but contingencies have to be considered.

Planting is done from early November to February, as circumstances permit, but owing to the large acreage in potatoes in this district, farmers are frequently much occupied in lifting these until late, and only a small proportion of swede is planted in November. The advantages of early planting are considerable: the plants recover from the check and become established before winter and in consequence get a quicker and better start in the spring. Given sufficient moisture in the land for the plants to strike root they would probably be better planted in October. If left too long on the bed they are apt to be drawn up, and if there is much chickweed, etc., may be weakened or choked out of existence.

Swedes are planted in rows from about 24 to 28 inches apart with about 6 to 12 inches from plant to plant, according to individual predilection. In this district planting is done with a tool resembling a shortened miniature spade, but a few planters use a dib. It is a good but not sufficiently followed practice to shorten roots before planting so that there are no long ends to double up. It may be argued in support of close planting that there is always a prospect of a proportion dying off. In favourable conditions the wider planting may be found to give the best average results, but there appears to be no golden rule in the matter as either on occasion yields heavily or the reverse.

Planting takes place either on land harrowed down and marked, out or in the furrow seams, according to the character or condition of the soil. Plants are occasionally ploughed in but this practice is not to be recommended. Rolling is often done after planting and again in the spring, especially if the land is found light. It is a fairly general practice to cut back swedes, especially if they are weak, to encourage spread of plant.

Swede seed is occasionally drilled to stand. In this case it is usually drilled later than for plants, perhaps late in August. The land has to be particularly clean for a drilled crop as it occupies the land for nearly twelve months: it is therefore mostly drilled on fallows and on fairly heavy land which is not much subject to annual weeds. On the average perhaps planting gives better results, although on occasions a drilled crop may come into bloom earlier and get away from the ravages of the turnip flower beetle. There is, however, a prejudice in the trade in favour of planted swedes. Hilling or moulding up is practised more with swedes than with turnips. Some fertiliser may be applied in the autumn, and in addition swedes require and are nearly always given in the spring a generous top dressing of sulphate of ammonia or nitrate of soda.

General Notes on Turnip and Swede Seed Crops.—The following observations apply generally to both the turnip and swede seed crops. It is desirable to grow different varieties well apart as there is a risk of natural cross fertilisation (especially with some varieties), producing undesired results. When in bloom the crops are rogued, *i.e.*, the false plants, which are distinguished from the true plant by a difference in colour of the flower, are removed. This is done by, or under the direction of men of experience, employed by the merchants contracting, or by their agents.

Seed should be thoroughly fit before cutting; it is sometimes diminished in yield and value by premature cutting, but the greatest danger is in premature stacking which may result in making seed useless for growing purposes.

Seed cutting commences in forward seasons with early varieties of turnip towards the end of June and with swede perhaps the end of July. It is cut by hand and tied with string and left usually for over a week in the field. The sheaves are laid lightly on the stubble and turned after weathering for a day or two, and in the event of rain are again turned or lifted. Showery weather after cutting does not damage the seed to any extent if it is turned or lifted. The custom is to lay the sheaves with heads to the north-east, most of the strong winds being expected from the south-west. In loading and carting, the crop has to be carefully handled to avoid waste of seed. It is usually put in small stacks to prevent heating and cloths are placed on the steddles to preserve seed which spills out freely when handling. Seed is occasionally thrashed "out of the field," in which case it has to remain longer in the field than when stacked. If stacked, turnip seed must stay in the stack fully six weeks, longer is desirable, and swede takes more time to condition.

The seed has to be very carefully thrashed (especially swede seed) to avoid damage, but machine owners in this district are experienced in the matter and on the whole do exercise care. One difficulty, however, is for farmers to obtain machines when wanted, and delivery of seed is often delayed. The average yield of turnip and swede seed is roughly about 24 bushels an acre, but on the best or new lands sometimes considerably more. Those, however, who attempt to grow either crop on moderate land are doomed to disappointment.

Mangold Seed.—Although this district is possibly better adapted for the production of swede and turnip seed than any other it cannot be claimed that it is so well suited in all respects for mangold seed and this is not grown to the same extent.

The trade place a proportion of their requirements here as a provision in case of failure of crops in other districts. It is seldom that crops fail altogether in this district, but better samples may be produced on drier soils and in other districts in some seasons.

As contrasted with swede and turnip seed new or extra rich land is not to be desired for mangold seed, which frequently fails to ripen early enough but persists in growing on. The land requires to be clean as mangold seed is a late crop. Stiff or heavy land usually produces the best seed and it holds crops up better. The crop is generally hilled up as it has not much root hold. As mangold seed is liable to natural cross fertilisation, varieties, and crops of different colour especially, should be grown well apart.

The usual method is to sow seeds in a plant bed about the first week in August and plant out in the autumn or spring. It is perhaps more common to plant in spring because it is thought that the plants on the beds are better protected from frost. If planted in the autumn there may be considerable losses, while if losses occur it is better to have them in the bed than in the field. On the other hand the autumn planted may come to hand slightly earlier, which is an advantage. The plants are usually set in rows about 27 inches apart and about 8 to 12 inches from plant to plant, sometimes wider. It is now an increasing practice to top plants when beginning to run—usually to pinch or take a small piece off the lead with the object of minimising risk of storm damage through the plants getting too tall, and to encourage the spread of laterals. Sometimes the crop is left till later, when the top is cut off with a hook, but this results in the crop being put back, which is not desirable.

The crop is cut by hand, tied in small sheaves, and put into small stooks, and it has to remain in the field for some time before it is fit to be stacked. It is usually put up in small and very narrow stacks and in this district, at least, stacks should always be ventilated. This is neglected at times and in consequence the stacks may heat and seed be rendered useless. Seed is not as a rule ready for threshing before Christmas.

Insect and Other Pests.—One cause of the failure of the turnip seed crop in the early stages, especially if the weather is hot and dry, is the turnip flea, and occasionally mustard bugs will clear off crops and are difficult to combat. Slugs are destructive, especially after peas and clover. Larks are destructive in severe weather (in the absence of other green food particularly) as also occasionally are wood pigeons. Chickweed is often very

troublesome to deal with, and if the weather does not permit of frequent cleaning it may smother the plant in its early stages or in the spring.

The turnip flower beetle has also done material damage to turnips and swedes when in bloom, in 1922 especially; hitherto it has not been found to do much damage to turnip seed, although swede has been damaged materially. The usual course of this pest is to start on the earlier varieties of turnip and follow on in succession as crops come into bloom, and then on to swede seed and brown mustard. Some efforts have been made to deal with this pest, usually with poisonous or nauseous washes or powders, but with no marked success. By the time the mischief is evident the crops are so far advanced that it is often impossible for a horse machine to get through them and difficult even for a man with a knapsack sprayer. The crops may recover to some extent but they come to hand later. An early season seems to be favourable to swede. For instance, in 1921, swede crops generally were good, as they got away from their enemies.

For several years past turnip gall weevil attack on swedes has been very marked, but the plants affected have not apparently failed more than clean plants. However, rooks may pull up the plants to get at the grub. One great trouble with swede is what is known locally as "Canker," which does not usually show itself till plants are running to seed and then they begin to break down, and in bad cases nearly all may go, so as to render the crop worthless. A stem maggot is also troublesome at times, although crops much infested have on occasion yielded well (in quick growing seasons).

The various pests affecting root seed crops call for serious investigation, especially perhaps the turnip flower beetle.

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BLOSSOM WILT OF PLUM TREES.

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THE object of the present note is to call the attention of fruit growers to unsuspected sources of infection for the Brown Rot diseases of fruit trees, particularly with reference to outbreaks of Blossom Wilt of plum trees, caused by *Sclerotinia* (*Monilia*) *cinerea* forma *pruni*.* In certain seasons the Blossom Wilt con-

* For a general account of the Brown Rot diseases caused by this fungus see the Ministry's Leaflet No. 367.

FIG. 1.—Young Branch of Plum Tree Killed-back by Infection through the Flowers.

FIG. 2.—The Flowers (seen in FIG. 1) through which Infection occurred: the Fructifications of the Fungus are present on the Flower-stalks.

dition assumes serious proportions, for not only are the flowers themselves destroyed but the fungus extends from the flowering spurs into the branches, which are killed back. When many of the young branches of a tree are killed in this way, a condition not infrequent on some varieties of plums, the brown withered flowers and leaves give the tree a noticeably "blighted" appearance.

The chief sources of infection for the primary outbreaks of the brown rot diseases on plum and cherry trees are the mummied fruits which are allowed to stay on the trees through the winter. Serious outbreaks of blossom wilt, however, may occur when there are no "mummies" in the immediate neighbourhood. In the case of the blossom wilt disease of apple trees,* caused by another specialised form of *Sclerotinia cinerea*, it has been shown that the sources of infection are the spore pustules which develop on the spurs killed the previous year and on the cankers. So also in the blossom wilt of plum trees serious outbreaks sometimes occur in the absence of mummified fruits and can be traced to cankers, dead twigs and spurs.

A case in point came under the writer's notice early in May this year. In a plantation of plum trees of three varieties, viz., Giant Prune, Czar, and Purple Egg, the Giant Prunes all showed a number of young branches killed back from the tip for a distance varying from about six inches to over a foot (Fig. 1), while the other two varieties were almost free from such damage. A close examination of the infected branches showed that at the lower end of every dead portion there was a flowering spur on which the flowers (through which the infection had occurred) were brown and withered, and usually bore grey tufts consisting of chains of spores produced by the fungus (Fig. 2). No mummied plums were to be found at all in the plantation, for care had been taken to remove from the trees, during the winter, all obvious sources of infection, and the nearest trees bearing "mummies" were too far away to account for the extent of the outbreak. A careful search on the trees, however, showed that here and there old dead twigs were present which had been killed by the brown rot fungus in the previous season, and had been overlooked when the rest of the dead wood had been cut out; these had produced spore pustules during the winter, and the numerous spores to which they gave rise served to infect the flowers as they opened. It was observed that the blossom

* See this *Journal*, Vol. XXIV, No. 5, August, 1917, pp. 504-513, and Leaflet No. 312.

wilt was most intense in the immediate vicinity of such dead twigs.

Now it is to be noted that the blossom wilt fungus of plum trees not only infects the flowers but also the young leaves and the fruit. When the leaves become infected the young shoots are killed, giving rise to the "Wither Tip"* condition when the leading shoots are killed, and to what has been termed "Shoot Wilt"† when the short lateral shoots become infected, in which case cankers usually arise on the branches. These cankers and dead shoots in their turn serve as further sources of infection. The fruit may become infected not only when ripening but also when in the green growing state.

It is obvious, therefore, that, if at all practicable, the dead branches resulting from an attack of blossom wilt should be removed *as soon as possible*,‡ and for two reasons: (1) The dead flowers serve as sources of infection for the leaves and fruit; (2) if the dead parts are removed early when the contrast between the dead and the living parts is striking, there is less likelihood of portions being overlooked as will almost certainly occur if the operation is left over until the winter.

After a severe infestation of brown rot the precaution should be taken of examining the trees again during the following winter and removing all mummied fruit and dead twigs and branches. It is sometimes almost impossible, however, to remove all sources of infection owing to the fact that fruit spurs and young lateral shoots are sometimes killed without the disease extending into the branches, and such small spots of infection, since they do not produce any conspicuous die-back, evade detection, especially in winter. An extra precaution to minimise the possibility of infection from such sources is to spray with the winter wash recommended for the brown rot diseases,§ viz., one containing 1 per cent. of soft soap and 1 per cent. of caustic soda, to be applied as late as possible but before there is any risk of injury to the opening buds.

Growers of cherries are reminded that the fungus which is responsible for these brown rot diseases of plum trees also causes blossom wilt and fruit rot of sweet cherries, and where plum

* Wormald, H. A. "Wither Tip" of Plum Trees. *Ann. Appl. Biol.*, Vol. V, No. 1, July, 1918, pp. 28-59.

† A Shoot Wilt and Canker of Plum Trees caused by *Sclerotinia cinerea*. *Annals of Botany*, Vol. XXXVI, No. 143, July, 1922, pp. 305-320.

‡ In the plantation referred to, the grower, realising the circumstances of the case, promptly set men to work cutting out the dead wood and all was removed during the second week in May.

§ See Leaflet No. 367.

trees are interplanted between rows of valuable standard cherry trees they may prove a menace to the latter unless careful attention is given to keep them free from the brown rot fungus.

* * * * * *

WART DISEASE OF POTATOES ORDER OF 1923.

THE Ministry has given serious consideration to the question of what further steps can be taken to arrest the spread of Wart Disease in England and Wales, and on the strong recommendation of its Potato Advisory Committee, supported by the Agricultural Advisory Committee, has issued the above Order, the chief object of which is to secure that growers shall be able to obtain seed potatoes free from infection.

The Order* revokes the previously existing Orders on the subject, and all growers of potatoes and all potato merchants and seedsmen are asked to make themselves familiar with the new requirements, the chief of which are summarised below.

(1) **Procedure in Cases of Outbreak of the Disease.**—The appearance of the disease on any land in England and Wales must at once be reported to the Ministry even though the presence of disease on that land has been reported in a previous year. Directions as to the measures to be taken by the occupier of the premises will be given by an Inspector.

Potatoes visibly affected with Wart Disease must not be sold or offered for sale for any purpose.

(2) **Restrictions on Planting Potatoes in Infected Land.**—In land on which Wart Disease has been known to exist at any time, the only potatoes which may be planted are those stocks of approved immune varieties which have been inspected while growing and officially certified as being true to type. (See also paragraph 4 as to general restrictions on planting.) A grower may, however, plant potatoes of approved immune varieties which have been saved by him from his previous year's crop on the same land.

A list of approved immune varieties may be obtained on application from the Ministry.

(3) **Infected Areas.**—The Order declares as an "Infected Area" the whole of Wales, the counties of Monmouth, Chester and Stafford, the whole of the county of Lancaster south of the River Ribble, together with Preston and Fulwood, North Salop, Birmingham and Sutton Coldfield, and certain parishes

* Copies and any further information may be obtained from the Ministry.

in the counties of Worcester and Derby. Several parishes which were certified under previous Orders, still remain Infected Areas. In addition, the provisions of previous Orders as to Infected Areas were applied to many groups of allotments and to a large number of premises, and these also are all Infected Areas under the present Order.

No potatoes grown in an Infected Area may be moved or consigned to any place in England and Wales which is not in an Infected Area. An exception to this rule is, however, made in the case of ware potatoes of approved immune varieties provided that a statement is made on the invoice or sale note relating to the consignment or in a label or ticket inserted in or attached to the package containing the potatoes, to the effect that the potatoes are of an approved immune variety, that they were grown in an Infected Area, and that they are not intended for planting. Any person receiving potatoes consigned from an Infected Area without this statement must notify the Ministry of the fact within seven days, and must not part with or plant the potatoes without the permission of the Ministry.

(4) **Restrictions on Planting Potatoes and on the Sale of Potatoes for Planting.**—The Order requires that all potatoes planted or sold for planting must have been officially certified either as having been grown on land free from Wart Disease, or as having been inspected and found to be free from the disease, or as being of an approved immune variety true to type. As regards seed grown in England and Wales, the certificates will be issued by the Ministry. The necessary inspections may be made by an Inspector of the Ministry or by some competent person previously approved by the Ministry. For Scotch seed the certificates will be issued by the Board of Agriculture for Scotland, and for Irish seed by the respective Ministries of Agriculture in Ireland.

When potatoes are sold for planting the seller must furnish the buyer with the number of the certificate relating to the potatoes sold. In order to assist both buyers and sellers of potatoes, it has been arranged that the certificate numbers shall have prefixes as follows:—

C.L. (= clean land) for potatoes grown in clean districts or from crops which have been inspected and no disease found.

T.S. (= true stocks) for approved immune varieties which have been inspected and found to be true to type.

The letter A will be used in addition for potatoes grown in an Infected Area, and the certificate numbers for such potatoes will thus have the prefixes A.C.L. or A.T.S.

The following simple but important directions should be carefully remembered when purchasing seed potatoes, whether of English, Scotch or Irish origin, in future:—

(*a*) When buying potatoes for planting in infected soil.	The certificate No. must be T.S.....; or A.T.S.
(*b*) When buying potatoes for planting in clean soil in an infected area.	C.L.....; A.C.L.....; T.S.....; or A.T.S.....
(*c*) When buying potatoes for planting in land which is not in an Infected Area and on which the disease has never appeared.*	C.L.....; or T.S.....

Certificates, however, will not be required by a grower who wishes to plant seed saved from the crop grown in the previous year on the same premises.

Potatoes grown outside Great Britain and Ireland must not be planted or be sold for planting in England and Wales except under a licence from the Ministry.

(5) **Arrangements for Issue of Certificates.**—Growers who intend to sell seed potatoes must make early application to the Ministry for the necessary certificates. Growers of immune varieties should apply for inspection of their crops whilst growing in order that they may obtain the certificate necessary to enable the potatoes to be planted in infected soil. If the crop is not inspected only a "C.L." or "A.C.L." certificate can be issued. It will be necessary in districts in and near Infected Areas for crops of susceptible varieties also to be inspected before a "C.L." or "A.C.L." certificate can be issued.

The Ministry will be prepared to arrange for the necessary inspections; the fee for inspection will be 2s. 6d. per acre or part of an acre. No charge will be made for the issue of certificates where no inspection by the Ministry's officers is entailed.

(6) **Restrictions on the Sale of Scotch and Irish "Ware" Potatoes.**—Purchasers of Scotch ware potatoes must obtain, either from the grower of the potatoes or the person in Scotland from whom they are purchasing, a statement, either that the potatoes were not grown in an Infected Area in Scotland, or that the potatoes are of an approved immune variety, or that the crop has been officially inspected and that Wart Disease was not found to exist thereon. This requirement does not apply to potatoes from Scotland sold within an Infected Area in England and Wales.

In the case of Irish ware potatoes the statement must be

* Potatoes with certificates bearing a number prefixed by A.C.L. or A.T.S. must on no account be planted in such land.

either that the potatoes are of an approved immune variety or that they were grown on land believed by the relative Ministry of Agriculture to be free from Wart Disease. This requirement also does not apply to potatoes from Ireland sold within an Infected Area in England and Wales.

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MONTHLY NOTES ON FEEDING STUFFS.

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Soft, Oily Bacon—Its Cause and Prevention.—In the June issue of the *Journal*, an interesting hypothesis has been developed as to the cause and prevention of soft, oily bacon. In that article the theory is developed that the main causes of oily bacon are (1) excessive oil in the diet, and (2) the chemical nature of the oil itself. The theory has been put forward after an investigation of cases which have occurred in bacon factories of pigs which, on curing for bacon, were found to produce soft, oily sides. It is therefore important to realise that the deductions made by the writer of the article and the figures indicating the "softening power" of various foods are only tentative and still require to be proved before being accepted by the general farming community as sound. The article is, however, of value in indicating the need for further research in this subject and as showing that, however skilful a bacon curer may be, his knowledge is useless unless the feeder provides the right raw material for him to work upon.

In consequence of the views expressed in the article referred to, it may perhaps be advisable at this stage to summarise such facts as are already known with regard to the production of body fat.

(1) The chemical composition of the natural body fat of animals varies with the species and the environment. The body fat of most species of animals consists chiefly of varying admixtures of palmitin, stearin and olein, the first two fats being solid at ordinary temperature, while olein is liquid.

(2) Fats can be built up by the animal body from all three foodstuffs, *i.e.*, proteins, fats and carbo-hydrates. As far as the writer is aware there is no preferential storage of body fat from fats originating from any of these three main classes of foodstuffs.

DESCRIPTION.	Price per Qr.		Price per Cwt.	Price per Ton.	Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit. Starch Equiv.	Price per lb. Starch Equiv.
	s.	lb.	s.	£ s.	£ s.	£ s.		s.	d.
t. British	—	—	11/3	11 5	0 18	10 7	71·6	2/11	1·56
t. British Feeding	—	—	9/3	9 5	0 14	8 11	71	2/5	1·29
Danubian ,,	30/-	400	8/5	8 8	0 14	7 14	71	2/2	1·16
Persian ,,	27/3	,,	7/8	7 13	0 14	6 19	71	1/11	1·03
English White	—	—	11/6	11 10	0 16	10 14	59·5	3/7	1·22
,, Black & Grey	—	—	11/-	11 0	0 16	10 4	59·5	3/5	1·83
Scotch White	—	—	12/8	12 13	0 16	11 17	59·5	4/-	2·14
Canadian No. 2 Western	29/9	320	10/5	10 8	0 16	9 12	59·5	3/3	1·74
,, No. 3 ,,	28/9	,,	10/1	10 2	0 16	9 6	59·5	3/2	1·70
,, Feed	26/6	,,	9/3	9 5	0 16	8 9	59·5	2/10	1·52
American	25/-	,,	8/9	8 15	0 16	7 19	59·5	2/8	1·43
Argentine	24/-	,,	8/5	8 8	0 16	7 12	59·5	2/7	1·38
e. American	39/-	480	9/1	9 2	0 15	8 7	81	2/1	1·12
Argentine	39/6	,,	9/3	9 5	0 15	8 10	81	2/1	1·12
s, English Winter	—	—	10/6	10 10	1 17	8 13	67	2/7	1·38
Rangoon	—	—	8/3	8 5	1 17	6 8	67	1/11	1·03
,s' offals—									
ean. British	—	—	—	6 0	1 10	4 10	45	2/0	1·07
,, Broad	—	—	—	7 15	1 10	6 5	45	2/9	1·47
ine middlings (Imported)	—	—	—	8 10	1 5	7 5	72	2/-	1·07
oarse middlings (British)	—	—	—	7 15	1 5	6 10	64	2/-	1·07
ollards (Imported)	—	—	—	6 7	1 10	4 17	60	1/7	0·5
ey Meat	—	—	—	9 12	0 14	8 18	71	2/5	1·34
,, ,,	—	—	—	10 5	0 15	9 10	81	2/4	1·25
Germ Meal	—	—	—	8 7	1 2	7 5	85·3	1/8	0·89
Gluten-feed	—	—	—	8 15	1 12	7 3	75·6	1/11	1·03
ast Bean Meal	—	—	—	8 0	0 11	7 9	71·4	2/1	1·12
n Meal	—	—	—	12 7	1 17	10 10	67	3/2	1·70
,, ,,	—	—	—	16 15	4 18	11 17	53	4/6	2·41
seed	—	—	—	20 7	1 16	18 11	119	3/1	1·65
,, Cake, English (9% oil)	—	—	—	10 5	2 4	8 1	74	2/2	1·16
ton-seed Cake, English (Egyptian Seed) (5½% oil)	—	—	—	7 5	2 0	5 5	42	2/6	1·34
,, ,, Egyptian (5½% oil)	—	—	—	7 0	2 0	5 0	42	2/5	1·29
,, Cake (6% oil)	—	—	—	8 7	1 15	6 12	73	1/10	0·98
n Kernel Cake (6% oil)	—	—	—	5 15*	1 7	4 8	75	1/2	0·62
,, Meal (2% ,,)	—	—	—	4 17	1 8	3 9	71·3	1/-	0·54
ding Treacle	—	—	—	4 15	0 9	4 6	51	1/8	0·89
ewers' grains, dried, ale	—	—	—	6 2	1 7	4 15	49	1/11	1·03
,, ,, ,, porter	—	—	—	5 15	1 7	4 8	49	1/10	0·98
,, ,, wet, ale	—	—	—	0 19	0 11	0 8	15	0/6	0·26
,, ,, wet, porter	—	—	—	0 15	0 11	0 4	15	0/3	0·13
d Cullins	—	—	—	8 0*	1 19	6 1	43·4	2/10	1·52

* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of May and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 5d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 15s. 6d.; P_2O_5, 4s. 3d.; K_2O, 2s. 10d.

(3) The composition of the body fat can be altered by the nature of the food given, and evidence exists which demonstrates the possibility of the storage in the body of food fat which is otherwise foreign to the organism. This fact has been demonstrated both in the case of the dog and the pig. Lean dogs fed with linseed oil developed fat which differed considerably from the normal body fat, this fat remaining liquid even at 32° F. On the other hand, lean dogs fed on mutton suet produced body fat which remained solid at 112° F. The addition of linseed oil to the diet of selected pigs also led to deposition of soft, oily fat, giving the characteristic smell of linseed oil, and containing substances peculiar to that oil.

There are two trials which the writer would like to see undertaken with pigs intended for bacon production. The first would be a comparison of linseed cake meal and oil extracted linseed cake meal, or maize meal and oil extracted maize meal. The result of such a trial would indicate the extent to which the production of soft fat is dependent upon the nature and amount of the oil present in the food, as apart from the character of the food itself. The second would be a comparison of three feeding stuffs selected from the table given in the article under discussion, one with a high softening power number, one with a medium number, and one with a low softening power number.

FARM VALUES.

CROPS.	Value per Ton on Farm. £ s.	Manurial Value per Ton. £ s.	Food Value per Ton. £ s.	Starch Equivalent per 100 lb.	Value per unit S.E. s. d.	Softening Power Number per lb. S.E.
Wheat	8 7	0 18	7 9	71·6	2 1	1·2
Oats	7 0	0 16	6 4	59·5	2 1	1·2
Barley	8 2	0 14	7 8	71·0	2 1	1·2
Potatoes	2 1	0 4	1 17	18·0	2 1	1·2
Swedes	0 18	0 3	0 15	7·0	2 1	1·2
Mangolds	0 16	0 3	0 13	6·0	2 1	1·2
Good Meadow Hay	3 16	0 16	3 0	31·0	1 11	1·3
Good Oat Straw	2 1	0 8	1 13	17·0	1 11	1·3
Good Clover Hay	4 5	1 4	3 1	32·0	1 11	1·3
Vetch and Oat Silage	1 16	0 8	1 8	14·0	2 0	1·5

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PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending June 13th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	13.15	13.15	13.10	13. 0	16. 9
,, ,, Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	16. 0*	16. 0*	16. 0*	16. 0*	(N)15. 5
,, ,, ,, neutral (A. 25¾ per cent.)	17. 3*	17. 3*	17. 3*	17. 3*	(N)16. 2
Kainit (Pot. 12½ per cent.)	...	..	...	2. 2	3. 4
,, (Pot. 14 per cent.)	2. 5	2. 1	2.10	2. 7	3. 5
Sylvinite (Pot. 20 per cent.)	...	...	...	3. 0	3. 0
Potash Salts (Pot. 30 per cent.)	...	...	...	4. 5	2.10
Muriate of Potash (Pot. 50 per cent.) ...	9.10	7.10	8. 0	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	...	12.15‡	11.15	11. 5	4. 8
Basic Slag (T.P. 35 per cent.)	...	...	...	3.12§	2. 1
,, ,, (T.P. 30 per cent.)	...	...	...	3. 0§	2. 0
,, ,, (T.P. 26 per cent.)	...	2.10§	...	...	...
,, ,, (T.P. 24 per cent.)	...	2. 6§	2. 7§	...	...
,, ,, (T.P. 20-22 per cent)	...	2. 3§	..	2. 7§	2. 4
,, ,, (T.P. 18 per cent.)	...	...	2. 0§	...	...
Superphosphate (S.P. 35 per cent.) ...	4. 7	...	4. 5§	3.15	2. 2
,, (S.P. 30 per cent.) ...	3.17	3. 5	3.15§	3. 7	2. 3
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9. 0	8. 7	...
Steamed Bone Flour (T.P. 60 per cent.) ..	8.10†	7.10†	7. 0	6.12	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13.12	...

Abbreviations: N.=Nitrogen: A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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Foot-and-Mouth Disease.—The existence of foot-and-mouth disease was confirmed on 20th June on premises at Skefflng, near Patrington, Hull, in the East Riding of Yorkshire. The slaughter of the affected and in-contact animals was immediately undertaken, and the usual prohibition of movement restrictions were applied to the area within a radius of fifteen miles of the infected premises.

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The Ministry's Register of Dairy Cattle.

THE Sixth Volume of the Ministry's Register of Dairy Cattle can be obtained either direct from the Ministry or from H.M. Stationery Office. The price of the Volume is 2s. 6d.

Although the Ministry's Milk Recording Scheme is now becoming generally known throughout the country, and the practice of milk recording is being increasingly adopted, apparently few breeders are aware of the existence of the Ministry's Register of Dairy Cattle. It is published annually, and its main object is to assist farmers by bringing to their notice cows which have an authenticated record of proved milk-yielding ability. The Register contains a list of breeders and owners of cows whose yields have been certificated by the Ministry. The standard which a cow must reach before it is eligible for entry in the Register is 8,000 lb. of milk yielded in one milk-recording year, or an average of 6,500 lb. in two or more consecutive milk-recording years. Any cow, moreover, which has yielded not less than 24,000 lb. of milk over a period of three consecutive years, and which has calved at least three times during that period, may be awarded a certificate of merit on application by its owner, and a list of such certificated cows is given in the Register.

An interesting feature of the Sixth Volume is the addition of a Bull Section, which is intended to be of use to farmers who desire to obtain the services of bulls of proved milking strain. Bulls are eligible for this section whose dams and sire's dams have been entered in the Register, or which have two or more daughters so entered.

The current Volume of the Register contains particulars of 1,500 cows representing 14 breeds other than cross-bred cows which have qualified under the conditions outlined above. Of these cows 1,350 qualified for entry on the one-year standard alone. It may be mentioned that only certificated cows are entered in the Register, and that consequently the number of cows contained in the current Volume is only a small proportion of those which would be eligible on their milk yields if their owners had applied for certificates. The Ministry hopes, however, that as the existence of the Register becomes more widely known and its object more generally understood, farmers will avail themselves of the useful information which it contains.

* * * * * *

Silver Leaf Order, 1923.

FRUIT growers are doubtless aware that in order to check the more rapid spread of silver leaf disease, which has done much damage throughout orchards in this country, the Ministry issued an Order in 1919 (Silver Leaf Order of 1919) making it obligatory on growers of plum trees to cut out and destroy all dead plum trees and all dead wood of plum trees before the 1st April in each year. Whilst much dead and infected wood has been destroyed during the last three years, the Ministry has, in virtue of the experience gained and the knowledge of more recent research, deemed it necessary to make some changes in the Order. The matter has been considered by the Ministry's Horticultural Advisory Council, and, on their advice, the Minister has now made a fresh Order known as The Silver Leaf Order of 1923, which came into effect on the 1st June, 1923.

This new Order requires that in future the work of destruction of dead trees and dead wood must be done in the case of apple trees as well as plum trees, and, the date laid down for completion of this work is the 15th July in each year instead of the 1st April.

In addition to these requirements, and apart from the Order, the Ministry strongly recommends growers to cover with anti-fouling paint, white paint, or tar, all wounds of apple and plum trees, whether made by cutting or pruning, or in any other way. Such wounds are particularly susceptible to the entry of the fungus, *Stereum purpureum*, which is the cause of silver leaf, and if they are left exposed there is a great risk of infection.

A copy of the Ministry's leaflet dealing with silver leaf and any further information on this subject that is available may be obtained on application to the Ministry at 10, Whitehall Place, London, S.W.1.

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Horticultural Research at the Long Ashton Station in 1922.

THE Annual Report of the Horticultural Research Station at Long Ashton, Bristol, contains short accounts of the experimental work which has been carried out at the Station during the year 1922 into problems concerning fruit production. The experiments on the manuring of fruit trees are particularly opportune, for on this subject information is either scanty or entirely lacking. The Long Ashton workers have realised that the fruit tree has two

functions to perform simultaneously, namely, to produce wood growth and to develop a fruit crop. The fruit grower, whilst naturally interested in securing vigorous growth in young trees, is more immediately interested in the production of a heavy crop, and has employed numerous methods of manuring to secure this end. Manuring in spring and in the autumn have been advised and criticised. Nitrogenous manures have been recommended by some and condemned by others; in short the manuring of fruit trees in the past has been a question of groping in the dark. The experimenters have given an account of the way in which trees act when starved of essential chemical elements, and fruit growers will realise the fundamental importance of ascertaining these facts before progress can be made with certainty. The results of these experiments should be read by all fruit growers, as they are very instructive as to the kind of manures that are required, and stimulative of thought as to the need for securing a proper balance of the different kinds.

It has been realised that in addition to manures other factors influence fruit bud formation, and the Report contains an account of the effect of "ringing" and "notching" in causing trees to produce fruit. For many years it has been known that fruit trees too productive of shoot growth could be induced to produce fruit by clamping the trunks with iron springs, and the Station has reported that the process of "ringing" causes a similar crop formation. In the present Report there is an account of an investigation as to the working of these processes.

Bush fruit has not been neglected, and the Report gives an account of work on the nomenclature of raspberries which has been conducted in co-operation with the Horticultural Research Station at East Malling, Kent. The Report shows the confusion existing with regard to raspberry varieties: and fruit growers will look forward with considerable interest to the further reports of this joint work.

The Station started as a National Fruit and Cider Institute, and whilst it has developed its activities in fruit in recent years, its interest and activities in connection with the making of cider have not declined, and there are several accounts dealing with cider. The growers of cider fruits in Worcestershire and Hereford will find it particularly interesting and instructive to read the surveys which have been made of the cider orchards in those two counties: whilst all growers of market varieties of

fruits will be interested to see that the Station has studied the problem, which has been ever present with them, of dealing with the small and culled apples of market varieties for cider purposes. The Report gives an account of the qualities of cider made from Allington Pippin, James Grieve, Lord Derby, Bramley Seedling, and other market varieties, and contrasts the vintage qualities of these ciders with that made from the ordinary cider sorts. Best cider, the Report states, can be made by judicious blending of ciders from vintage varieties, adjusting deficiencies in quality, and exercising control of the fermentation, so that the resultant vintage has the right proportions of acid, sugar and tannin. Market varieties are deficient in tannin, and generally possess too much acid, so that to utilise surplus table fruit to profitable account by conversion into cider, it is necessary to blend with these a proper proportion of vintage kinds, selected to add the qualities which are lacking in ciders from market sorts and balancing where excesses occur. It is a practical problem with which the majority are concerned, and if a successful solution were discovered might lead to the withdrawal of the inferior samples of market fruit from the commercial markets, to the benefit of the whole fruit industry.

Accounts of experimental work on insect pests and diseases of fruit trees are given. There is a full account of the life history and control of the Apple Blossom Weevil, a pest which for many years has caused considerable damage to young fruit blossoms.* Not the least interesting or important is the work which is being done on the physiology of Leaf Scorch, a trouble which has come much to the fore in recent years in districts where fruit is being grown on light types of soil, such as exist in Norfolk and parts of the west. The problem, apparently, is not an easy one, but the Report shows that the matter is being investigated on somewhat broad lines. It is clear that the absence of potash, as was at one time believed by many, is not the primary cause of this scorch, but that sudden interruptions of the water supply are a more serious factor in inducing its appearance.

The Report of this work is written in a manner which will appeal to the average fruit grower, and should be widely read.

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* See this *Journal*, October, 1922, p. 637.

THE following account of a pig feeder's experiences in Suffolk has been communicated to the Ministry by Mr. A. W. Oldershaw, B.Sc., County Agricultural Organiser, for East Suffolk :—

Green Food and Minerals for Pigs.

Mr. R. Flatman, of Mellis, who has very successfully practised dry feeding of late, had a litter of pigs born on 1st September, 1922; they were bred at home, the sow being a Large Black, and the boar Large White. The young pigs had access to the dry feeder when quite small and still suckling, and went entirely on to it when taken from the sow. The following mixture was used :—65 per cent. barley meal, 25 per cent. middlings, and 10 per cent. fish meal.

The pigs were kept in an open stock yard, with deep sheds, and the yard was divided into sections by iron hurdles. There was thus a nice comfortable shed for the pigs to go into, whilst they could also go into the open air at will, but they had not access to any soil.

The pigs were on the sow for 8 weeks and did well until 12 weeks old, when the best pigs began to lose the use of their hind legs and became very dull. The hair also began to grow too much.

Mr. Flatman was aware of the research work on animal nutrition which is being conducted at the Rowett Institute at Aberdeen, and at Cambridge University, and he communicated an account of the trouble to these bodies.

As a result of advice given by them he began to give the animals green food, the green tops only of marrow-stem kale, as the pigs would not eat the stems. He also placed in reach of the pigs a mixture of chalk and sifted house cinders—the result of burning half wood and half coal. The treatment began about Christmas time.

The green stuff was eaten well, and the chalk and ashes mixture was also picked up from the trough from time to time. There was a gradual improvement in the symptoms until the pigs were better. They also ceased rooting amongst the manure, etc. In the later stages of fattening the fish meal in the mixture was reduced to 5 per cent., and 10 per cent. of gram substituted.

The first pig was killed on 31st January and weighed 9 stones dead weight; the second, killed about 10th February, weighed 10 st. 7 lb. The remaining nine, killed on 21st February, averaged 9 st. 9 lb. dead weight. In all six out of the eleven pigs were over ten stones at about twenty-five weeks old, which

was not bad considering the set back they had owing to their illness.

Incidentally it is interesting to note that Mr. Flatman finds that the dry system of feeding is very economical in labour. A boy, aged 15, looks after 96 pigs.

There appears to be little doubt that the recovery of the pigs was due to the feeding of green stuff, chalk and ashes, and the whole incident forms an interesting instance of the value to the farmer of recent work on animal nutrition, which has brought out the value of green stuff in supplying necessary vitamines and of an ample supply of mineral substances to rapidly growing animals such as pigs. It is true that in the experiments by Professor White and Mr. Roberts (this *Journal*, April, 1923) the value of green food was not found to be so great as is commonly supposed. Nevertheless, pigs quite commonly suffer from symptoms such as those given above. The cost of supplying the necessary green food is very small and it undoubtedly brings the feeding of the pigs nearer to a state of nature. The chalk and ashes also cost practically nothing, and the fact that the pigs relish them seems to indicate that the minerals supply a natural craving. Pigs grow very rapidly and undoubtedly require a large quantity of mineral matter for their bones, etc. The foods commonly fed to them do not often contain a very large proportion of mineral matter. In a state of nature pigs, by rooting amongst the earth, are probably able to obtain what they require. When shut up in buildings or stock yards they cannot do this, and hence it appears only common sense to supply them with any minerals they will eat.

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QUESTIONS IN PARLIAMENT.

Conciliation Committee Agreements.—In answer to a question asked by Mr. Noel Buxton in the House of Commons, on the 4th June, as to whether the Minister of Agriculture could state when the Bill dealing with the compulsory registration of conciliation committee agreements will be introduced, Sir Robert Sanders replied that he was not yet in a position to make an announcement on the subject.

Sheep Dipping Order.—Mr. Westwood asked the Minister of Agriculture in the House of Commons, on the 7th June, if he was aware that, for two years prior to the passing of the Double Dipping (Sheep) Order, 1920, there were 790 outbreaks of sheep scab in the United Kingdom; that, in the

two years since the passing of the Order, there have been 1,440 outbreaks; and that the Order is a costly failure and is causing grave dissatisfaction and great loss to sheep farmers in the South of Scotland; and would he consider the revoking of an Order which has failed in the purpose for which it was enacted?

The *Minister of Agriculture* (*Sir Robert Sanders*) replied:—The reply to the first part of the question is in the affirmative. The increased number of outbreaks merely indicates that more cases of scab are being brought to light, and I cannot agree that the Order has failed in its purpose. As the Sheep Double Dipping Order, 1920, has not been applied to the South of Scotland, I presume the second part of the question must refer to the Regulations which local authorities make for their own protection. While insufficient care in cleansing flocks of scab still persists in certain districts in Wales and Scotland, I should not feel justified in asking these local authorities to withdraw their Regulations. I am aware of the feeling on this matter which exists in the South of Scotland, and I may say that the Ministry is about to issue a fresh Order dealing with sheep scab on lines which I hope will eventually lead to the stamping out of this disease.

Labelling of Dried Milk.—Mr. Lamb asked the Minister of Health in the House of Commons on 3rd May, whether his attention had been directed to an advertisement of Milkal, household milk, which is described as machine-skimmed milk from which only the water has been eliminated; and whether, in view of the implied suggestion that only the water has been eliminated and not the butter fat, he would say what action he proposed to take for the protection of the consumer who may not be aware of what is actually removed by the process of machine skimming?

Lord E. Percy (Parliamentary Secretary to the Ministry of Health) replied "Yes, Sir. My right hon. friend's attention has been drawn to the advertisement in question, and he agrees that it is likely to mislead readers as to the nature of the article advertised. He has no power to take action with regard to such advertisements, but he is considering Regulations to provide for the proper labelling of dried milks."

In reply to a further question on 13th June, Mr. Neville Chamberlain, Minister of Health, said that the Regulations were in draft.

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REPLIES TO CORRESPONDENTS.

Feeding of Dried Nettles.—L.P. asks for information as to feeding of nettles to stock.

Reply: Stock will not touch fresh nettles, but when dried they have, according to Emil Pott (*Handbuch der tierischen Ernaerhrung*, 1904, I, p. 102), a good effect on the yield of dairy cows and the coats of horses.

According to R. Gouin (*Les Aliments du Bétail*, 1922, p. 67) they should be cut before flowering and allowed to wilt for some little time on the ground, and then given in mixture with some dry fodder to minimise their laxative

effects. He adds that they may be dried, but are then better fed, after being moistened with hot water, with the addition of salt.

Feeding Brussels Sprout Stems.—M.O. asks about feeding Brussels sprout stems to stock.

Reply: Brussels sprouts—the entire plant—have been successfully fed to sheep in times of vegetable glut. Stock will consume with relish the leafy parts of the plant but the coarser and more fibrous parts will be avoided, particularly late in the season.

Similarly, in the case of marrow-stem kale* it is usually found that stock do not much relish the stems after Christmas.

Eradicating Ground Elder.—A.Y. asks whether spraying would be of use.

Reply: The Ministry does not recommend spraying for the eradication of ground elder.

Constant hoeing of the ground and cutting off the leaves as soon as they appear, as recommended in Leaflet No. 194 for the eradication of coltsfoot, would probably get rid of the weed in the course of a year or two, but to be really useful it must be done frequently.

Sawdust Manure.—B.W. asks whether sawdust might be used to soak up liquid manure for application to the land.

Reply: Sawdust does not decompose in the soil as readily as straw, and when used on the land it has a tendency to promote the growth of fungi. Where sawdust is used for litter, the resulting manure should preferably be applied to grass land.

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Leaflets issued by the Ministry.—Since the date of the list given on page 283 of the June issue of the *Journal*, the following leaflets have been revised.

No. 242.—"Stripe" Disease of Tomatoes.
" 262.—Tomato Leaf Rust or Mildew.
" 355.—Growing Wild White Clover and Late-Flowering Red Clover for seed.

The following new leaflets have been issued.

No. 397.—White Clover.
" 398.—Town Refuse as Manure.

The following leaflets have been re-written.

No. 151.—Cleanliness in the Dairy.
" 300.—The Breeding of Utility Pigeons.

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* For feeding to Poultry, see this *Journal*, May, 1922, p. 177.

NOTICES OF BOOKS.

Heredity in Poultry.—(R. C. Punnett, F.R.S. London: Macmillan & Co., Ltd., 1923, 204 pp., 10/- net.) No one is better qualified to write with authority on heredity than Professor Punnett, and a book by him devoted entirely to heredity in poultry will be welcomed by all interested in the breeding of the fowl. It is to experiments with poultry that we owe much of our fundamental knowledge of Mendelian principles as applied to animals. In particular the illuminating interpretation of "dominance" and "recessiveness" in terms of "presence" and "absence"—first applied to explain the heredity of comb characters in poultry—was the result of experiments involving many thousands of birds carried out by Bateson and Punnett in the early years of the present century. It is safe to say that the genetic analysis of the fowl is more complete than that of any other animal. Nevertheless, the author is careful to point out that our knowledge, extensive as it is, is practically limited to *visible* characters (such as colour of plumage, nature of comb). For example, little is yet known regarding such an important invisible character as fecundity. It is true that Pearl in America advanced the theory that fecundity is mainly a "sex-linked" character—that high egg-laying capacity is passed from father to daughter and from mother to son, but not direct from mother to daughter. The author, however, is of opinion that this theory requires confirmation. Similarly, he questions whether there is any trustworthy evidence that size or shape of egg is transmitted through the male. The investigation of invisible and economic characters generally presents considerable difficulties to the scientist. It is interesting to learn that there is some prospect of such investigations becoming easier, for there is some reason to think that when invisible characters are sex-linked, as they often appear to be, they may be closely associated with visible sex-linked characters. If this should prove to be the case, early advances in knowledge may be hoped for. The book would be improved by tables showing the genetic analysis of each breed of fowl, that is to say, giving particulars of the characters in each breed regarding which precise knowledge is now available.

It may be added that Professor Punnett's work constitutes a valuable text-book on the Mendelian theory generally, and as such should prove of great value to students of Genetics.

Market Milk.—(Ernest Kelly and Clarence E. Clement. London: Chapman & Hall, Ltd., 1923. 445 pp., 19/- net.) This book is practical and interesting and should prove of use to a wide circle of readers. The opening chapter dealing with the consumption of milk and dairy products in the United States is of considerable interest, showing the estimated consumption per head of the population to be about 1 pint per day. It is also stated that the number of cows kept, in comparison with the population, has declined steadily from 287 cows per thousand people in 1840 to 218 in 1921.

Sections devoted to milk as a food for adults and infants are of considerable interest. The chapters dealing with bacteriology and the production of milk of a low bacterial count are well written and full of useful data. The latter should be carefully read by all interested in clean milk production, emphasising as it does the necessity of cleanliness in the cowshed, sterilization of utensils and prompt and efficient cooling,

In connection with the organization of milk control, the inspection of iry farms and town depots is dealt with at some length. The educational tures of dairy inspection are of interest, stress being laid on the utility of an milk competitions as a means of interesting both producer and retailer clean milk production. Score cards as used by inspectors when inspecting iry farms and city plants are given. Producers' Co-operative Milk Dis- uting Organisations receive consideration, the necessity of their establish- nt, the advantage to producers and methods of financing being fully essed. Care is taken to point out the essentials without which the nation of Co-operative Societies cannot be undertaken with success.

hapters on city milk plants, with plans, and on pasteurisation will be of erest to those handling city milk supplies.

As the authors state, no treatment of market milk problems is complete thout a discussion of milk prices and the cost of distribution under various adings. Table 95 shows that according to Hibbard and Erdman costs of stribution, *i.e.*, transportation, handling of plant, and delivery, amounted to per cent. of the total cost of production in 1917 in Chicago and other cities. is evident that the authors have made an exhaustive study of this question, d the student will obtain useful and interesting information from a care- l study of these chapters.

The milk trade in all its aspects is dealt with in this book, but we lay it wn with a feeling that the authors have been unable to find solutions to the ny hard problems with which the trade is faced.

Landwirtschaftliche Samenkunde. — (Dr. Ludwig Wittmack. rlin: Paul Parey, 1922, pp. viii. 581.) This is a second edition of the thor's "Gras- und Kleesamen" published as far back as 1873. After some rty years of teaching, retirement has afforded the leisure to produce what is actically a new book. It is divided into two sections—(1) General, to page 2, and (2) Special, pages 112 to 513. In the former, the trade in agricultural eds and seed control, with the machinery used in cleaning and the apparatus ed in testing are dealt with, and the biology of seeds generally discussed. the special section the various species are dealt with individually—grasses ering some hundred pages, and leguminosae about eighty. The ore important economic plants are described, notes are added as to thology and chief countries of origin, and liberal references to literature ven. Papers as late as those of Hernfrid Witte on the colour of red clover eds, and of E. Lindhard on natural and artificial breeding of red clover och 1921) are noted in the body of the work, while in the "Addenda" dates recent as 1922 are to be found. The book is well and fully illustrated and ould prove of considerable value. There is a full index and an excellent bliography.

Die Kultur der Wiesen.—(4th Edition. Professor W. Strecker. Berlin, 923, pp. 502); and **Erkennen und Bestimmen der Wiesengräser.**— 9th Edition. Professor W. Strecker. Berlin, 1923, pp. 250.) These two books plement each other. In the former practically everything involved in the tablishment and care of meadows is discussed—clearing, drainage, irrigation nd overhead watering, and fencing occupy the first 150 pages. Then follow novation, laying down to grass and manuring. A chapter on the care of eadows deals with animal and insect pests (a strong plea is put up for the

mole), weeds and methods of cultivation, rolling, harrowing, etc. The last hundred pages comprise harvesting and conservation as hay or silage. The writer is an enthusiast—his motto is "Better grassland, more cattle—more cattle, more manure and consequently better arable." He leans to rotation as opposed to permanent grass as giving scope for the introduction of new and improved varieties.

The smaller book may be described as a manual of grasses. It is, like the larger, fully illustrated, and contains useful tables, grouping the various grasses under such heads as top grasses, bottom grasses and so forth. Specimens of seeds mixtures for meadows and pastures, under various conditions, are given.

Egg-in-Kums.—(By "Sonimor." The "Sonimor" Egg Farm, Leckhampstead, Newbury, Berks, 1923, XV + 120 pp. 43 illus. Price 5/-.) Mr. Hector Morison has here presented a very readable account of the equipment and methods of commercial egg farming in use at the "Sonimor" Egg Farm. He is an enthusiastic advocate of large flocks both for laying stock and chicks, and he explains that the methods advocated in his book apply only to large units. The opinion is expressed that there need be no limit to the size of a flock or houses provided that the building and organisation are right. The author believes that the use of modern labour-saving appliances is justified by the increased efficiency of the attendants and the greater interest which they take in their work. Nine workers do everything on the farm including incubation and chicken rearing. He finds that 1½ workers per 1,000 adult stock are ample for all purposes.

The farm is run for the sole object of egg production and for this purpose the White Leghorn is strongly recommended.

Descriptions are given of the construction and equipment of the incubator house, brooder house, colony houses, cockerel houses, laying sheds, breeding sheds, and granary. A granary attached to each house to hold one week's supply is found to minimise labour in feeding. These chapters are illustrated with photographs which show clearly the construction, arrangement, and fittings, and plans are given. Two mammoth incubators of 6,000 egg capacity are installed. The large brooder house accommodates 5,000 chicks in units of 500. A light blue colouring in the brooder house is recommended as a preventive of toe-pecking. The methods employed in incubating and brooding are fully described and many interesting comments are made.

Over 30,000 chicks are hatched each season. The pullets are drafted from the brooder to asbestos colony houses accommodating 150 to 200. They are allowed to perch at once.

Two sizes of laying sheds are in use. The larger ones, housing 1,500 birds, are 400 ft. long and 16 ft. wide: the smaller houses, 160 ft. long by 14 ft. wide, accommodate 500 layers. Each house is built in the centre of a plot of land, the northern portion of the plot being used in summer and the southern in winter. The northern plot is larger because birds are out more in summer than in winter. About an acre of land is allowed to every 500 birds.

Mr. Morison has recently been experimenting with the use of electric light in his pullet houses from dusk to 7.30 p.m. He finds that the extra cost of light is much more than balanced by the increased winter egg-yield. Dry mash is fed to both old and young birds. Interesting chapters are given on

he water supply, egg packing, collecting and storing, and business methods in ommercial egg farming.

The stock of adult birds numbers 6,000, made up of 3,000 pullets, 2,000 econd season birds, and 1,000 three year olds. Mr. Morison has kept records hich show that his pullets will average 150 to 160 eggs per bird per year, econd year birds 130 to 135, and third year birds 120 to 125. He maintains hat it pays to keep birds at least three years and gives figures in support of is contention. His basis of calculation, however, is 2s. 6d. per dozen in each ase and no allowance is made for winter eggs laid by the pullets. It is assumed that anyone farming on a really commercial basis will need at least 000 laying stock. The cost of raising this number and purchasing the ecessary equipment is estimated at £3,500. Twenty or thirty acres is entioned as a useful size for a farm and some hints are given on the choice situation.

This book is a valuable addition to the poultryman's library, which is rely lacking in books devoted entirely to poultry farming. It is sure to be ad with interest by all engaged in egg farming.

The British Goat Society's Year Book.—(British Goat Society, Fenchurch Street, E.C.3. Price 1s. 6d.) The third year book of the British oat Society (Mr. T. Palmer, Honorary Secretary) contains more than twenty rticles by well-known goat breeders, as well as articles by medical men, eterinary surgeons and others. There was recently a special importation of oats from the Continent* and a detailed account is given by Mr. Palmer of he difficulties which were overcome in the search for suitable stock in Holland nd Switzerland. Mr. Holmes Pegler gives a history of previous importations old days, with amusing accounts of how the regulations governing importation ere occasionally evaded.

Dealing with the value of goats' milk for children, Dr. Ker Bell says: When cows' milk is prescribed for bottle feeding it is generally diluted with ater, lime water or barley water, and this does not appear necessary in the se of goats' milk, which is soon tolerated undiluted." Dr. W. R. Hadwen in is article on "Malta fever and Goats' Milk" refutes the stigma generally ttached to goats' milk in this connection and attributes the decline of fever to emoval of insanitary surroundings.

On the veterinary side of goat keeping, Mr. H. Stainton writes on Sterility" and says that there are three general factors which militate against eductiveness in any animal, namely unnatural conditions, inbreeding, and xcessive breeding, such as that carried out for the purpose of heavy milk roduction.

Dr. F. A. E. Crew has carried out research work on "Developmental ntersexuality in the goat" at Edinburgh and gives the results of his investiations. The volume is illustrated with numerous photographs, and contains he Rules and Regulations of the Society and a list of the names and addresses f members.

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* See this *Journal*, February, 1923, p. 1023.

ADDITIONS TO LIBRARY.

Agriculture, General and Miscellaneous.

Hendrick, J.—The Farmer's Raw Materials: Air, Water, Soil and Manure. (211 pp.) Edinburgh: W. Green & Son, Ltd., 1923. 6s. net. [63.11(02); 63.16(02).]

Löhnis, F., and *Fred, E. B.*—Textbook of Agricultural Bacteriology. (283 pp.) New York and London: McGraw-Hill Book Co., 1923. 12s. net. [576.8(02).]

Cutler, D. W., Crump, L. M., and *Sandon, H.*—A Quantitative Investigation of the Bacterial and Protozoan Population of the Soil, with an Account of the Protozoan Fauna. [Philosophical Transactions of the Royal Society of London, Series B, Vol. 211, pp. 317-350.] London: Harrison & Sons, 1922, 4s. [63.115.]

Shaw, Sir Napier.—The Air and its Ways: The Rede Lecture 1921, of the University of Cambridge, with other Contributions to Meteorology for Schools and Colleges. (xix + 237 pp. + 24 plates.) Cambridge: University Press, 1923, 30s. net. [551.5.]

Carrier, L.—The Beginnings of Agriculture in America. (xvii + 329 pp.) New York and London: McGraw-Hill Book Co., 1923, 14s. net. [63(73).]

Field Crops.

Strecker, W.—Die Kultur der Wiesen ihr Wert, ihre Verbesserung, Düngung und Pflege. [4te. Aufl.] (502 pp.) Berlin: Paul Parey, 1923. [63.33(*a*).]

Strecker, W.—Erkennen und Bestimmen der Wiesengräser im Blüten- und blutenlosen Zustande sowie ihr Wert und ihre Samenmischungen für Wiesen und Weiden. [9te Aufl.] (250 pp.) Berlin: Paul Parey, 1923. [63.33(02).]

University College of Wales, Welsh Plant Breeding Station.—Bull. 3, Series C., Seasons 1921-22:—Preliminary Investigations with Oat. (59 pp.) Aberystwyth, 1923, 5s. [63.314.]

Ontario Department of Agriculture.—Bull. 296:—Sweet Clover. (16 pp.) Toronto, 1923. [63.33(*b*).]

U.S. Department of Agriculture.—Bull. 1146:—The Influence of Copper Sprays on the Yield and Composition of Irish Potato Tubers. (26 pp.) Washington, 1923. [63.295(04); 63.512(04).]

Cornell Agricultural Experiment Station.—Memoir 57:—A Study, by the Crop Survey Method, of Factors influencing the Yield of Potatoes. (140 pp.) Ithaca, 1922. [63.512(04).]

Plant Diseases.

Nebraska Agricultural Experiment Station.—Bull. 186:—Potato Diseases in Nebraska. (32 pp.) Lincoln, 1923. [63.21; 63.23; 63.24-33.]

North Dakota Agricultural Experiment Station.—Bull. 166:—Diseases of Grain and Forage Crops in North Dakota. (92 pp.) Agricultural College, N.D., 1923. [63.24-31; 63.24-33.]

Anderson, O. G. and *Roth, F. C.*—Insecticides and Fungicides. Spraying and Dusting Equipment: A Laboratory Manual with Supplementary Text Material. (xvi + 349 pp.) New York: John Wiley; London: Chapman & Hall, 1923, 15s. net. [63.294; 63.295.]

Live Stock.

Ohio Agricultural Experiment Station.—Bull. 358:—Winter Rations for Breeding Ewes. (pp. 127-196.) Wooster, 1922. [63.621: 043.]

Harris, J. M. and *Mackenzie, K. J. J.*—Pigs for Different Markets: Paper read on May 5, 1923, to the Cambridge and District Farmers' Federation, Ltd., and National Farmers' Union, Cambridge Branch, together with the Discussion thereon. (15 pp.) Cambridge, 1923. [63.64(04).]

Northampton County Council, Education Committee.—Farm Institute Bull. 2 (New Series):—Pig Keeping in Relation to the Future of British Farming. (8 pp.) Northampton: County Education Offices, 1923, 3d. [63.64(04).]

Bonnett, F. et al.—Outdoor Pigs: How to make them pay. (147 pp.) London: Rolls Publishing Co., 1923, 2s. 6d. [63.64(02).]

Smith, W. W. and *Shanklin, F. M.*—The Pig Book for Boys and Girls. (171 pp.) Philadelphia and London: J. B. Lippincott Co., 1923, 5s. net. [63.64(02).]

North Carolina Agricultural Experiment Station.—Bull. 244 :—Methods and Costs of Raising Pigs to the Weaning Age. (15 pp.) Raleigh, 1922. [63.64(04).]

Ohio Agricultural Experiment Station.—Bull. 355 :—Self-Feeding Swine. (pp. 19-50.) Wooster, 1922. [63.64 : 043.]

Oregon Agricultural Experiment Station.—Bull. 196 :—Finishing Pigs for Market. (20 pp.) Corvallis, 1923. [63.64 : 043.]

U.S. Department of Agriculture.—Bull. 1143.—Pasture Crops for Hogs at Huntley, Mont. (24 pp.) Washington, 1923. [63.33(04); 63.64 : 043.]

Veterinary Science.

Missouri Agricultural Experiment Station.—Bull. 201 :—The Practical Control of Infectious Abortion in Cattle. (11 pp.) Columbia, 1923. [619.2(a).]

Ohio Agricultural Experiment Station.—Bull. 356 :—Some Pests of Ohio Sheep. (pp. 51-79.) Wooster, 1922. [619.3.]

Poultry and Bees.

Lamon, H. M. and *Lee, A. R.*—Poultry Feeds and Feeding. (247 pp.) New York : Orange Judd Co.; London : Kegan Paul, 1922, 10s. 6d. [63.65 : 043.]

Lamon, H. M. and *Slocum, R. R.*—Ducks and Geese. (245 pp.) New York : Orange Judd Co.; London : Kegan Paul, 1922, 12s. [63.657; 63.658.]

Pellett, F. C.—Productive Bee-Keeping : Modern Methods of Production and Marketing of Honey. 3rd Edition. (316 pp.) Philadelphia and London : J. B. Lippincott Co., 1923, 25s. net. [63.81.]

Economics.

Wright, I.—Farm Mortgage Financing. (343 pp.) New York and London : Mc-Graw-Hill Book Co., 1923, 15s. net. [333.33(02); 332.71(73).]

Pulbrook, E. C.—English Country Life and Work. (243 pp.) London : B. T. Batsford, Ltd., 1922, 16s. net. [63(42); 331.]

Missouri Agricultural Experiment Station.—Bull. 199 :—Co-operative Live Stock Shipping Associations in Missouri. (10 pp.) Columbia, 1923. [63.6 : 38; 334(06).]

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